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(54) Method for detecting ralstonia solanacearum race 3 biovar 2

(57) The invention concerns a method for the detection of *Ralstonia solanacearum* race 3 biovar 2 strains in a medium, comprising the determination of the presence or the absence in a sample of the medium, of:
(i) at least one first nucleic acid target having a sequence selected from the group constituted of SEQ ID NO: 1-49, complementary sequences thereof, and homologous sequences thereof, or
(ii) at least one fragment of said first target nucleic acid, wherein said fragment is not constituted of or comprised in a sequence selected from the group constituted of SEQ ID NO: 111-140;

whereby, if said first nucleic acid target or fragment thereof is present in the sample, it is determined that *Ralstonia solanacearum* race 3 biovar 2 strain is present in the medium.

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Description

Field of the invention

[0001] The present invention relates to a method for detecting race 3 biovar 2 *Ralstonia solanacearum* strains.

Background of the invention

[0002] *Ralstonia solanacearum* is a Gram-negative soil-borne plant pathogen with thousands of distinct strains in a heterogeneous species complex. *Ralstonia solanacearum* causes bacterial wilt, which is globally distributed and economically destructive. It is thus considered the single most destructive bacterial plant disease because of its unusually broad host range. The bacterium attacks plants in over 200 different families, including dicots and monocots, and annual plants as well as trees. Economically important crop hosts include: tomato, potato, pepper, tobacco, peanut, ornamentals, banana, plantain, and eucalyptus. Losses due to bacterial wilt are known to be enormous but cannot be accurately estimated because of its large but undocumented impact on subsistence agriculture and because planting of wilt-susceptible crops have been abandoned altogether in many parts of the world. Specifically, economic losses to the potato industry in the world have been estimated 950 million US $ and the potato brown rot strain of *Ralstonia solanacearum* was listed in the USA as a Bioterrorism Select Agent (BSA).

[0003] The pathogen usually enters host roots from the soil, multiplies in the root cortex, and colonizes the xylem vessels, so the bacteria spread rapidly throughout the host via the plant's own vascular system. Symptoms vary according to host, but rapid wilting and death are the common elements.

[0004] To unravel the genetic diversity within this species complex, a new classification scheme was proposed that distinguishes four phylotypes:

- phylotype I corresponds to the "Asiaticum" division 1 of Cook et al (1989) and contains strains belonging to biovars 3 (GMI1000), 4 and 5;
- phylotype II corresponds to the "Americanum" division 2 of Cook and contains strains belonging to race 1 biovar 1, race 2 biovar 1 (e.g. Moko disease-causing strains such as Molk2), race 3 biovar 2 (e.g. IPO1609 and UW551) and race 3 biovar 2T strains;
- phylotype III contains strains from Africa and the Indian Ocean, which belong to biovars 1, 2 and 2T;
- phylotype IV is reported highly heterogeneous; it contains strains from Indonesia, some strains from Japan, and a single strain from Australia, belonging to biovars 1, 2 and 2T; phylotype IV also contains the closely related species *Ralstonia syzigii* and the blood disease bacterium (BDB).

[0005] Each phylotype can be further subdivided into sequevars based on differences in partial sequence of the endoglucanase gene (eg/). The phylotyping scheme is broadly consistent with the former phenotypic and molecular typing schemes (Fegan and Prior, 2005: Prior and Fegan 2005), and adds valuable information about the geographical origin and in some cases the pathogenicity of strains. It is believed that, after the race/biovar classification, the phylotype classification scheme is to become the core organizing principle for assigning a particular strain a phylogenetic position with a predictive value on potential host range (Fegan and Prior, 2006; Wicker et al., 2007).

[0006] Whole genome sequencing was decisive in unravelling the broad genetic diversity encompassed within this organism with unusually broad host range. Thus a metagenomic microarray from sequence data of a broad host range tomato phylotype I strain (GMI1000) has been developed which has enabled comparative genomic hybridizations demonstrating that a third of the *Ralstonia solanacearum* genome is constituted of variable genes probably acquired by horizontal gene transfers. The distribution of variable genes between strains is related to the phylotype classification (Guidot et al, 2007).

[0007] Recent phylogenetic evidences indicated that strains that fit with the definition of the potato brown rot agent were placed into the phylotype IIB sequevar 1 and 2, *i.e.* the biovar 2 Andean strains of *Ralstonia solanacearum* historically known as race 3 biovar 2. These strains are highly pathogenic to potato and adapted to low temperatures. Some strains in that group were also reported to carry an enlarged host range including tomato, and *Geranium rosa* (Carmeille *et al.,* 2006).

[0008] Given, the important economic impact of potato brown rot, it is highly desirable to develop methods for specifically detecting race 3 biovar 2 *Ralstonia solanacearum* strains.

[0009] Thus, WO 2004/042016 relates to real-time PCR primers and probes useful for the detection of such strains. The primers and probes enable the detection of a nucleic acid sequence which is specific for race 3 biovar 2 *Ralstonia solanacearum* strains.

[0010] However, it appears that the nucleic acid sequence detected by the primers and probes of WO 2004/042016 is that of a mobile genetic element, since this sequence encodes part of a protein homologous to the Mu-like phage of

the ORF35 of the B3 bacteriophage from *Pseudomonas aeruginosa* (Accession Q7AX27).

[0011] In general, mobile genetic elements should be avoided in the frame of the specific detection of a pathogenic microorganism, since particular strains of the pathogenic microorganism could lack the element or, conversely, other unrelated microorganisms could harbour the element, thereby yielding respectively false negative and false positive results.

[0012] Accordingly, it is an object of the present invention to develop a method for detecting race 3 biovar 2 *Ralstonia solanacearum* strains which involves the detection of specific nucleic acid sequences which do not belong to mobile genetic elements.

Description of the invention

[0013] The present invention arises from the identification, by the inventors, of genomic portions of *Ralstonia solanacearum* which are specific of the race 3 biovar 2 strains of *Ralstonia solanacearum*.

[0014] Thus the present invention relates to a method for the detection of *Ralstonia solanacearum* race 3 biovar 2 in a medium, comprising the determination of the presence or the absence in a sample of the medium, of:

(i) at least one first nucleic acid target having a sequence selected from the group constituted of SEQ ID NO: 1-49, complementary sequences thereof, and homologous sequences thereof, or
(ii) at least one fragment of said first nucleic acid target, wherein said fragment is preferably not constituted of or comprised in a sequence selected from the group constituted of SEQ ID NO: 111-140;

whereby, if said first nucleic acid target or fragment thereof is present in the sample, it is determined that *Ralstonia solanacearum* race 3 biovar 2 is present in the medium.

[0015] The present invention also relates to the use of:

(i) at least one first nucleic acid target having a sequence selected from the group constituted of SEQ ID NO: 1-49, complementary sequences thereof, and homologous sequences thereof, or
(ii) at least one fragment of said first target nucleic acid, wherein said fragment is preferably not constituted of or comprised in a sequence selected from the group constituted of SEQ ID NO: 111-140;

for detecting *Ralstonia solanacearum* race 3 biovar 2.

[0016] As intended herein the "medium" can be of natural or synthetic origin. Where the medium is of synthetic origin, it can in particular be a solid or liquid bacterial culture medium, Where the medium is of natural origin, it can notably be water, soil, or a biological tissue, in particular a plant tissue. Preferably, the medium is selected from the group constituted of a potato tissue, a tomato tissue, and a geranium tissue. These plant tissues are particularly prone to infection by *Ralstonia solanacearum* race 3 biovar 2. However, it is particularly preferred that the medium is a potato tissue, since *Ralstonia solanacearum* race 3 biovar 2 is the causative agent of potato brown rot. Preferably, the potato tissue should be the tuber, which constitutes the potato tissue most likely to contain *Ralstonia solanacearum* race 3 biovar 2.

[0017] As intended herein a "sample" relates to a portion of the medium liable to contain nucleic acids. In particular, it is preferred that the sample is obtained from the medium by a nucleic acid extraction. Numerous methods exist, which are well known to one of skill in the art, for extracting nucleic acids from a medium, in particular from a plant tissue.

[0018] As intended herein "nucleic acid" preferably relates to RNA or DNA.

[0019] As intended herein "determination" of the presence or the absence of a nucleic acid in a sample relates to the detection of the full length nucleic acid in itself, but also to fragments of the nucleic acid. The present inventors have shown that genetic material transfers which have occurred in the course of evolution and which have structured the genome of *Ralstonia solanacearum* race 3 biovar 2 concerned genomic patches often involving several genes. These genomic patches correspond to SEQ ID NO: 1-49. Accordingly, the detection of fragments of these genomic patches is generally indicative of the presence of the nucleic acid as a whole. Besides, even if portions of SEQ ID NO: 1-49 should be lacking in a particular race 3 biovar 2 strain of *Ralstonia solanacearum,* it will be clear to one of skill in the art that the detection of fragments of conserved portions of SEQ ID NO: 1-49 is sufficient to unambiguously determine the presence of *Ralstonia solanacearum* race 3 biovar 2.

[0020] Thus, as intended herein a "fragment" should be of a length such that it can be considered by one of skill in the art that it presents essentially no identity with nucleic acids of the same length which can be found in *Ralstonia solanacearum* strains which are not of race 3 biovar 2. Preferably, fragments according to the invention comprise at least 9 nucleotides, more preferably at least 15 nucleotides and most preferably at least 18 nucleotides.

[0021] Exemplary fragments of the above-mentioned genomic patches notably encompass gene and inter-gene sequences SEQ ID NO: 50-110.

[0022] Some short portions of SEQ ID NO: 1-49 are of a known length but of undetermined sequence. It will be apparent

to one of skill in the art that the above-defined fragments of SEQ ID NO: 1-49 should preferably not be constituted of these short portions.

[0023] The inventors have also found that the genomic patches they identified comprised sequence derived from mobile genetic elements. These mobile genetic elements are represented by SEQ ID NO: 111-140. Accordingly, the method and use according to the invention should preferably not determine the presence or absence of these mobile genetic elements or fragments thereof as first target nucleic acids.

[0024] As intended herein "homologous sequences" relate to natural variants of sequences SEQ ID NO: 1-49, which can be found in strains of *Ralstonia solanacearum* race 3 biovar 2. Thus the homologous sequences notably encompass:

- sequences which are derived from sequences SEQ ID NO: 1-49 by insertion, deletion or substitution of at least one nucleotide;
- sequences which are liable to hybridize under stringent conditions to the complementary sequences of SEQ ID NO: 1-49;
- sequences which present at least 95% identity to sequences SEQ ID NO: 1-49;

provided the homologous sequences are specific to *Ralstonia solanacearum* race 3 biovar 2.

[0025] In a particular embodiment of the above-defined method and use, the determination comprises at least one step of hybridization of the nucleic acid target or fragment thereof with a probe or a primer. Preferably, the probe or primer is a fragment of nucleic acid having a sequence selected from the group constituted of SEQ ID NO: 1-49, homologous sequences thereof, and complementary sequences thereof. More preferably, the probe or primer is selected from the group constituted of SEQ ID NO: 141-386.

[0026] In another particular embodiment of the above-defined method and use, the determination comprises at least one step of nucleic acid amplification.

[0027] Preferably, where the determination comprises a step of nucleic acid amplification, the determination is implemented by a method selected from PCR and NASBA. NASBA is notably described in Compton (1991) Nature 350:91-92.

[0028] Also preferably, the determination is implemented by a method selected from Southern blotting, Northern blotting, dot blots, and nucleic acid micro or macro-array hybridization,

[0029] In a particular embodiment of the invention the above-defined method and use also comprise the determination of the presence or the absence in a sample of the medium, of:

(i) at least one second nucleic acid target having a sequence selected from the group constituted of SEQ ID NO: 111-140, complementary sequences thereof, and homologous sequences thereof, or
(ii) at least one fragment of said second nucleic acid target.

[0030] Indeed, since the at least one first target sequence is preferably not a mobile genetic elements, the determination of the presence or absence of nucleic acids corresponding to mobile genetic elements can be effected in a further step.

[0031] The present invention also relates to a nucleic acid having a sequence selected from the group constituted of SEQ ID NO: 1-22, SEQ ID NO: 50-110, SEQ ID NO: 111-140, SEQ ID NO: 141-246, and SEQ ID NO: 247-386 and their complementary sequences.

[0032] The present invention also relates to a nucleic acid micro or macro-array comprising a plurality of nucleic acid probes arranged onto a solid support, wherein the nucleic acid probes are fragments of nucleic acids having sequences selected from the group constituted of SEQ ID NO: 1-49, complementary sequences thereof, and homologous sequences thereof, provided that preferably at least one of the nucleic acid probes is not a fragment of a nucleic acid having a sequence selected from the group consisting of SEQ ID NO: 111-140.

[0033] Preferably, in the above-defined nucleic acid micro-array, the nucleic acid probes comprise SEQ ID NO: 247-386.

[0034] The present invention also relates to a kit intended for the detection of *Ralstonia solanacearum* race 3 biovar 2 in a medium, comprising at least:

- two primers suitable to amplify a portion of a nucleic acid having a sequence selected from the group constituted of SEQ ID NO: 1-49 and complementary sequences thereof, provided that said portion is preferably not comprised in a nucleic acid having a sequence selected from the group consisting of SEQ ID NO: 111-140 and complementary sequences thereof;
- optionally one detectable nucleic acid probe suitable to hybridize to said amplified portion.

EXAMPLE

Materials and methods :

• *Bacterial strains used in this study*

[0035] **Table 1** provides the list of the 14 race 3 biovar 2 strains and 45 non-race 3 biovar 2 strains used herein together with their geographical origin, host of origin. The 14 race 3 biovar 2 strains corresponded to phylotype IIB, sequevar 1 based on the classification scheme proposed by Fegan & Prior (2005).

• *Microarray* :

[0036] A 12X draft of the genome sequence from strain IPO1609 (a race 3 biovar 2 strain accessible from the *Collection Française de Bactéries Phytopathogènes* under accession number CFBP 6926) has been established in collaboration with Genoscope and annotated by the inventors. The deduced amino acid sequence of the genes thus identified was compared with the amino acid sequence of the genes previously identified in strain GMI1000 (Salanoubat *et al.,* 2002). All the genes from IPO1609 that did not have a homolog (less than 40% identity over at least 80% of both the query and subject sequences) will be further referred to as "potential IPO1609-specific genes". For each of these genes a specific representative 70 mer-oligonucleotide was designed using ROSO algorithm (Reymond, 2004). These oligonucleotides were chosen as having no significant homology with any part of the genome of strain GMI1000 and were used to generate a microarray as previously reported for the construction of the GMI1000 microarray (Occhialini *et al.,* 2005). The "IPO1609 partial microarray" thus generated also includes additional oligonucleotides representative of the IPO1609 allelic variants for a limited number of genes conserved but significantly divergent between strains GMI1000 and IPO1609 (mostly including type III-secretion dependant pathogenicity effectors) therefore permitting the distinction of the two allelic forms of a given gene. Finally, a limited number of oligonucleotides representative of particular intergenic regions were also included on the microarray. The sequence of each individual oligonucleotide spotted on the microarray has been deposited at *Agence de Protection des Programmes* (APP) under accession number IDDN.FR.001.300024.000.R.P. 2006.000.10300.

• *Genomic DNA extraction, DNA labelling, microarray hybridization, hybridization signal measurement and analysis.*

[0037] These have been performed as previously described (Guidot *et al.,* 2007) except that standard control DNA used for all genome hybridizations experiments which were performed consisted of an equimolar combination of the genomic DNA from three sequenced strains GMI1000, IPO1609 and Molk2 (IPO1609 and Molk2 genomes being unpublished) (Molk2 is accessible from the *Collection Française de Bactéries Phytopathogènes* under accession number CFBP 6925 and from the ATCC under accession number BAA-1115). Analysis was conducted as previously described using ImaGene and GeneShight (BioDiscovery) softwares. A gene was considered as being absent in the tested strain when the base 2 logarithm of the ratio of the normalized hybridization signal of the tested strain over the normalized hybridization signal with the control DNA was lower to -1.

• *PCR validation*

[0038] The list of candidate race 3 biovar 2-specific genes deduced from comparative genomic hybridizations (CGH) experiments was checked by PCR amplification. The PCR primers used are given in **Table 2.** The primers were designed to amplify one genomic fragment from each gene. When possible, one of the two primers for each gene was designed inside the oligonucleotide spotted on the microarray. PCR were conducted in 25 µl reaction mixture containing 10 ng DNA from each tested strain, 25 pmol of each primer (UR), 1.5 mM $MgCl_2$, 200 µM of each four dNTP, 0.5 U of Red Gold Star Taq DNA polymerase (Eurogentec) and the buffer supplied by the manufacturer. PCR amplifications were performed as follows: an initial denaturation step at 96°C for 5 min followed by 30 cycles of 94°C for 15 s., 59°C for 30 s., and 72°C for 30 s., with a final extension step of 72°C for 10 min. Negative (PCR reaction mixture without DNA) and positive (IPO1609 DNA) controls were included in each experiment. The multiplex PCR described by Fegan & Prior (2005) for the *Ralstonia solanacearum* phylotype identification was conducted on each tested DNA as an amplification positive control.

• *In silico comparison of strains UW551 with IPO1609, GMI1000 and Molk2 strains*

[0039] The deduced amino acid sequence for each predicted gene from strain UW551 was BlastX compared to the genomic sequence of strain IPO1609 in order to identify the predicted proteins of UW551 that have no counterpart

covering at least 80% of their length. These proteins designated as "potential UW551-specific proteins" were then compared with BlastX to the genomic sequence of strain GMI1000 and Molk2. All the proteins that did not have a counterpart covering at least 80% of the length of the query sequence with at least 40% identity where then individually compared using BlastP with the predicted proteins from strains GMI1000 and Molk2. This was performed in order to eliminate false candidates that could remain in the list due to frameshift in the nucleotide sequence.

Results:

• *Analysis of the distribution of "potential IPO1609-specific genes" among a collection of strains representative of the diversity* of Ralstonia solanacearum.

[0040] Comparative genomic hybridizations (CGH) on the microarray have been performed to compare the lists of genes between 11 race 3 biovar 2 strains and 20 non-race 3 biovar 2 strains **(Table 1).** This analysis identifies a set of 137 oligonucleotides which are present in at least 10 of the 11 race 3 biovar 2 strains and absent from at least 19 of the 20 non-race 3 biovar 2 strains. These oligonucleotides were representative of 79 genes and 38 intergenic regions from the IPO1609 genome. These genes and intergenes therefore were considered as "candidate race 3 biovar 2 specific genomic regions". A large proportion of these regions forms clusters in the IPO1609 genome and sometime a few genes mapping within these clusters were not found in the list of thus defined "candidate race 3 biovar 2 specific regions". Based on

i) the known mosaic structure of *Ralstonia solanacearum* genome that suggests that sets of genes could have been acquired through horizontal gene transfers or lost through deletions (Salanoubat et al., 2002 ; Guidot *et al.*, 2007),
ii) on the consideration that some genes might be missing from this list due to the fact that hybridization data are missing in a limited number of cases, and
iii) taking into account the possibility that certain genes that score next to the cutoff value could have been miss-categorized,

the inventors included into the list of the "race 3 biovar 2 specific regions" all the sets of 1 or 2 contiguous genes that were not originally detected as being race 3 biovar 2 -specific but that are located within a race 3 biovar 2 -specific gene cluster. Based on these criteria 34 additional genes were included into the list of race 3 biovar 2 -specific genes. These additional genes are identified with a star (*) in **Table 3.**

[0041] When compared using BlastP with the sequence of the predicted proteins from strains GMI1000 and Molk2, 5 of these genes were found to have a counterpart in at least one of these strains and were therefore eliminated from the final list of race 3 biovar 2 -specific genes presented in **Table 3.** This final list includes a total of 151 genes or intergenic regions organized in 18 clusters and 15 additional individual genes or intergenic regions.

• *Validation of candidate* race 3 biovar *2-specific genomic regions.*

[0042] The list of candidate race 3 biovar 2-specific genomic regions given in **Table 3** has been established based on the analysis of a limited number of strains. Therefore the inventors validated this list on a larger collection of strains representative of the diversity found in *Ralstonia solanacearum.*

[0043] A total of eight race 3 biovar 2-strains (among-which six were also used for CGH experiments) and 32 non-race 3 biovar 2 strains (seven of which were also used for CGH experiments) were used for this validation **(Table 1)**. This validation was conducted by PCR amplification of one genomic fragment from each candidate race 3 biovar 2-specific region. All tested DNA could be amplified using the multiplex PCR for the *Ralstonia solanacearum* phylotype identification as described by Fegan and Prior (2005) therefore confirming that the strains tested actually correspond to *Ralstonia solanacearum* isolates.

[0044] Each genomic region that gave a positive amplification from non-race 3 biovar 2 strains or a negative amplification from race 3 biovar 2 strains was excluded from the list of "race 3 biovar 2 specific genomic regions". The results validated the specificity of eleven gene clusters and eleven individual genes or intergenic regions **(Table 4)**. Among these genes, 27 were predicted to be parts of mobile genetic elements (bacteriophage or insertion sequences).

• *Identification of additional candidate* race 3 biovar *2-specific genes in strain UW551*

[0045] A genomic draft for the race 3 biovar 2 virulent isolate UW551 is publicly available (Gabriel *et al.* 2006). Because strain IPO1609 probably harbours a genome deletion that significantly impairs its virulence compared to UW551, the inventors decided to compare the genome sequences for these two strains. In doing this 328 predicted genes from UW551 that had no counterpart in IPO1609 were identified. Based on the same criteria, *in silico* comparison of these

328 genes with the genome sequence of strain Molk2 and GMI1000 reduced this set to 94 UW551 specific genes. Comparison of these 94 predicted proteins using BlastP with the proteins of GMI1000 and Molk2 eliminated 67 proteins that were not previously detected as having a counterpart in GMI1000 or Molk2 due to the presence of a potential frameshift mutation in the corresponding genes, therefore leading to a final list of the 27 UW551 specific genes shown in **Table 5.**

List of tables

[0046]

Table 1: List of *Ralstonia solanacearum* strains used in this study (ND not determined, NO no object)

Table 2: List of the oligonucleotides used for PCR amplification of candidate race 3 biovar 2 specific genes. (a) Sequences in bold correspond to part of the oligonucleotide spotted on the microarray

Table 3: List of candidate race 3 biovar 2-specific genomic regions.*Added genes correspond to the genes that have been included into the list based on their location within clusters of race 3 biovar 2 specific gene clusters.

Table 4: Validated race 3 biovar 2 -specific genomic regions together with sequences of the PCR primers used for gene amplification. Black boxes highlight genes from mobile genetic elements (bacteriophage or insertion sequences).

Table 5: List of additional candidate race 3 biovar 2-specific genes identified from strain UW551.

Table 1

Strain ID	Host	Origin	Race	Biovar	CGH on microarray	PCR verification
IPO1609	Potato	Netherlands	3	2	Yes	control +
JT516	Potato	Reunion Is.	3	2	Yes	Yes
CMR34	Tomato	Cameroon	3	2	Yes	Yes
RE	Potato	Uruguay	3	2	Yes	Yes
AP31 H	Potato	Uruguay	3	2	Yes	
AP42H	Potato	Uruguay	3	2	Yes	Yes
TB1H	Potato	Uruguay	3	2	Yes	
TB2H	Potato	Uruguay	3	2	Yes	
TC1H	Potato	Uruguay	3	2	Yes	Yes
TB10	Potato	Uruguay	3	2	Yes	
ETAC	Potato	Uruguay	3	2	Yes	
RM	Potato	Uruguay	3	2	Yes	Yes
PSS525	Potato	Taiwan	3	2		Yes
CMR24	Potato	Cameroon	3	2		Yes
CIP10	Potato	Peru	3	2T		Yes
NCPPB3987	Potato	Brazil	3	2T		Yes
Molk2	Banana	Philippines	2	1	Yes	
CIP418	Peanut	Indonesia	2	1	Yes	
UW9	Heliconia	Costa Rica	2	1		Yes
CFBP1183	Heliconia	Costa Rica	2	1		Yes
UW163	Plantain	Peru	2	1	Yes	
Ant75	Heliconia	Martinique	NO	1	Yes	
Ant80	Anthurium	Martinique	NO	1	Yes	
Ant307	Anthurium	Martinique	NO	1	Yes	
JY200	Anthurium	Martinique	NO	1	Yes	
JY201	Anthurium	Martinique	NO	1	Yes	
Ant1121	Anthurium	Martinique	NO	1	Yes	Yes

(continued)

Strain ID	Host	Origin	Race	Biovar	CGH on microarray	PCR verification
CFBP6797	Solanum	Martinique	NO	1		Yes
CFBP7014	Anthurium	Trinidad	NO	1		Yes
TOM=T1	Tomato	Uruguay	2	1	Yes	Yes
B34	Banana	Brazil	2	1	Yes	Yes
A3909	Heliconia	Hawai	2	1	Yes	Yes
CIP239	Potato	Brazil	1	1		Yes
CIP301	Potato	Peru	1	1		Yes
CFBP2957	Tomato	Martinique	1	1		Yes
CMR39	Tomato	Cameroon	1	1		Yes
ICMP7963	Potato	Kenya	1	1		Yes
CFBP6942	Solanum	Cameroon	NO	2T	Yes	Yes
CFBP6941	Tomato	Cameroon	NO	2T	Yes	
CMR43	Potato	Cameroon	NO	2T		Yes
CIP358	Potato	Cameroon	NO	2T		Yes
CFBP3059	Eggplant	Burkina Faso	NO	1	Yes	Yes
CMR66	Solanum	Cameroon	NO	2T		Yes
JT525	Pelargonium	Reunion Is.	NO	1		Yes
JT528	Potato	Reunion Is.	NO	1		Yes
J25	Potato	Kenya	NO	2T		Yes
NCPPB332	Potato	Zimbabwe	NO	1		Yes
GMI1000	Tomato	Guyana	1	3	Yes	
CMR134	Solanum	Cameroon	1	3	Yes	
CIP365	Potato	Philippines	1	3		Yes
R288	Morus alba	China	1	5		Yes
PSS358	Tomato	Taiwan	1	3	Yes	
PSS190	Tomato	Taiwan	1	3	Yes	
PSS219	Tomato	Taiwan	1	3		Yes
ACH732	Tomato	Australia	NO	2		Yes
Psi07	Tomato	Indonesia	NO	2T		Yes
Psi36	Tomato	Indonesia	NO	2T		Yes
MAFF301558	Potato	Japan	NO	2T		Yes
R. syzygii R28	Clove	Indonesia	NO	NO	Yes	Yes

Table 2

Gene name	Primer name	Primer sequence (a)	Product size (bp)	SEQ ID NO : 1
IPO_00030	IPO_00030_L	**ACTTGGAGAGATTTACGGAGGAG**	200	387
	IPO_00030_R	AAGCAAACGAGATAAGGGAGAAC		388
IPO_00031	IPO_00031_L	AAACACAATTCACCTTCCTGATG	185	389
	IPO_00031_R	**GGCCACTAGACTTTCCAGTGAT**		390
IPO_00034	IPO_00034_L	AGCTTACCTGCTGTTCGACATCT	818	391
	IPO_00034_R	**GTTCTTCGTGATAGCGGAGACT**		392
IPO_00043	IPO_00043_L	CTGAATTCGAAAAGGATAGAGCA	206	141
	IPO_00043_R	CTCGACAAACTCTTGCAACTGAC		142
IPO_00044	IPO_00044_L	**CTATGCAGAAGCGTTGCTTGTT**	191	143
	IPO_00044_R	CTTTAGCGAGCACAAGATTGAGT		144
IPO_00045	IPO_00045_L	**GAGATCGTTGGAAACATCAAGAC**	165	145

(continued)

Gene name	Primer name	Primer sequence (a)	Product size (bp)	SEQ ID NO : 1
	IPO_00045_R	GTGAACCACTATTGCCGGTATC		146
IPO_00233	IPO_00233_L	AGAACTGCCAAGTTCGACTACCT	207	147
	IPO_00233_R	**CATTCCAACGTTCAGATGGTTAT**		148
IPO_00234	IPO_00234_L	GCAGAAAAGATATCCCCTGCAC	214	149
	IPO_00234_R	**TTCGAGTACAAATGTAGGCTTCC**		150
IPO_00875	IPO_00875_L	GATCAGATGGAGCAAAGAACACT	221	151
	IPO_00875_R	TATTGAAACTCTTCACGGGTCAT		152
IPO_00876	IPO_00876_L	**TTTCGACCAAGAAAAGCATAGAG**	238	153
	IPO_00876_R	ATTTCTGTGCCCACTACGAACTA		154
IPO_00877	IPO_00877_L	TGGTGTTCTAACTGTGGAAGGTT	163	155
	IPO_00877_R	TACCGCCAGTCATATCAGTTCTT		156
IPO_00878	IPO_00878_L	**ATTAGACTGATCAAGGCATGGAA**	152	157
	IPO_00878_R	CCTTCATTATTGAGACGGTCAAG		158
IPO_00879	IPO_00879_L	**ATGTTTGTGCTACTGGTCAGTCC**	223	159
	IPO_00879_R	CCTTCACTTGCAGATAATGGAAC		160
IPO_00881	IPO_00881_L	AAAGAAGCTCAAGGAGATCAAGG	201	161
	IPO_00881_R	**AACAGCAGGTTGTGATACTGCAT**		162
IPO_01030	IPO_01030_L	TATGAATGGGTTGATAGCGTTCT	165	393
	IPO_01030_R	**CCATATCCACCGATAAACAACAT**		394
IPO_01058	IPO_01058_L	**CGAGCTCATCGTTATCGACAT**	140	163
	IPO_01058_R	AAGCTCTTGGACTAGGACGATCT		164
IPO_01131	IPO_01131_L	**CACGATATGACCACGATCAACTA**	195	395
	IPO_01131_R	GTAGACACGAATCACGTCTCCAT		396
IPO_01132	IPO_01132_L	**ACATCAACGACCCTTACTGTCC**	147	397
	IPO_01132_R	GACCATAGTCATCGCTGCTTAAC		398
IPO_01137	IPO_01137-1_L	CTATCCCGCAGAAGGTATTCAAC	186	399
	IPO_01137-1_R	AGTCATAGGCGTCTCGGTACTT		400
	IPO_01137-2_L	ACACTCTGTTCACCAAGTACGG	217	401
	IPO_01137-2_R	**CTTTGAAACTGGAGGAACAGCTT**		402
IPO_01259	IPO_01259_L	**TGAAATGCTCAAAGACAAACAGA**	235	165
	IPO_01259_R	ATCGTACAGGTCATTGCCAAAT		166
IPO_01260	IPO_01260_L	TACAACCTGAAGAGGATCTCGAA	225	167
	IPO_01260_R	**AAAGCCGGTCATAGAGGACATAG**		168
IPO_01311	IPO_01311_L	**CAACCAGACCATCTACAAGATCC**	165	169
	IPO_01311_R	GCTTCATACTCAAATCGAACACC		170
IPO_01312	IPO_01312_L	AACTCCAACTTGCTTGACTGTTC	208	171
	IPO_01312_R	GGATGAACTTCGTTCGATTGAG		172
IPO_01314	IPO_01314_L	GAAGCTCGGTGATATCGAAAC	287	173
	IPO_01314_R	GGTGATCGCTGTCGATAATTT		174
IPO_01362	IPO_01362_L	**AATTGGGTATACGTGATCTGTGG**	280	243
	IPO_01362_R	TCGGGTAAGACGAAGCTGACTA		244
IPO_02090	IPO_02090_L	CAATAGAAATTGCCGAGGTGATA	171	239
	IPO_02090_R	**CCTTGATAAGGATGTTCAACGAC**		240
IPO_02092	IPO_02092_L	AACACTCAAAAGCTGACCATCAT	151	403
	IPO_02092_R	**CAACCTTGATCTGTTCGGAGAC**		404
IPO_02095	IPO_02095_L	GTTGCAATGCTGGTTTCCAAG	157	405
	IPO_02095_R	**GTCATGGACGAGAAATCGATAC**		406
IPO_02097	IPO_02097_L	**CTCAGAGGATCTGTTCATCGACT**	160	407
	IPO_02097_R	GTTGAAGACGCCGAAGAAAAA		408
IPO_02098	IPO_02098_L	**ACGAGATTCCTGAAGCTGAGGT**	192	409

(continued)

Gene name	Primer name	Primer sequence (a)	Product size (bp)	SEQ ID NO : 1
	IPO_02098_R	CTTGCAGAACCTGACACATGA		410
IPO_02102	IPO_02102_L	GTATCAGAAAGGCCAGCTACACA	207	175
	IPO_02102_R	**CTGATTGCCAATATTCGATTCTC**		176
IPO_02140	IPO_02140_L	AAGGGCAATGGCTTTTTCTGT	153	177
	IPO_02140_R	**GAGACTGATAAATCAGCGTTTCC**		178
IPO_02141	IPO_02141_L	GCTTTCTACGTCGCCTCAGTAT	225	179
	IPO_02141_R	**GTAACGGTCTGATTCTTGAGGTTT**		180
IPO_02142	IPO_02142_L	CCACTACCCCTGTTTCCATTC	245	181
	IPO_02142_R	AAACCTGTAGTCGTCGTCCTTG		182
IPO_02143	IPO_02143_L	**AGACGTTGGACAACATCAACC**	189	183
	IPO_02143_R	AGTTCTGTTCGTCGTCGTGAAT		184
IPO_02144	IPO_02144_L	**CCAGTATTCCAAGACGCTATCC**	189	185
	IPO_02144_R	AACGGATACAGCAGCAGGTTT		186
IPO_02145	IPO_02145_L	ATACCCAGCGCGTATTCCAA	164	187
	IPO_02145_R	**GTTGAGGCAACACCAGACAG**		188
IPO_02146	IPO_02146_L	CTTGAGAAAGCTTTTGGTGAAGA	166	189
	IPO_02146_R	**CTTTGAGACCTTCCCAGGCTAA**		190
IPO_02147	IPO_02147_L	TAAGAGCAGGCTATGGACAACAT	209	191
	IPO_02147_R	AATACCAGCACACAGAAGGTCAG		192
IPO_02148	IPO_02148_L	**CTGATTTCCATGTACCTGCATC**	235	193
	IPO_02148_R	ACATCAGCACGTTCTTGTAGAGC		194
IPO_02149	IPO_02149_L	GACGATGAGTTGCTGAAGTACC	237	195
	IPO_02149_R	TGAAGGTAATGGTCACAGCTTTT		196
IPO_02150	IPO_02150_L	**ATCCGGTTCCTTCTGATGATCT**	124	197
	IPO_02150_R	CTTCAACTTCACGTGTTCAATCA		198
IPO_02151	IPO_02151_L	GCTAGTCCACACGACAAAATCAT	163	199
	IPO_02151_R	**GTGACTAGCTTGGCGATCTTCT**		200
IPO_02152	IPO_02152_L	**AGGTGAAGTGCTCGAAATCCT**	284	201
	IPO_02152_R	CTTCTTCCTTCTCGATGCCTTC		202
IPO_02153	IPO_02153_L	TTATGTGGCTTTCTCTGGCAATA	228	203
	IPO_02153_R	**ACAAACGTCCAGTCGTCAATC**		204
IPO_02154	IPO_02154_L	CATTTATCTCTGGTCTTGGCTTG	173	205
	IPO_02154_R	**ACAGCCAAACTGACAAGATCG**		206
IPO_02155	IPO_02155_L	GCATGAAAATGTCTACGTTCCTC	491	207
	IPO_02155_R	ATGGTGATAGTGCGGAATGAC		208
IPO_02156	IPO_02156_L	**CAGACATGTTCTGCGAAGGAT**	283	209
	IPO_02156_R	GAGGAACGTAGACATTTTCATGC		210
IPO_02157	IPO_02157_L	TGTAATGACCAAGCAAGAACTCA	112	211
	IPO_02157_R	**CACGGTGTCAAGAATGGTTTC**		212
IPO_02158	IPO_02158_L	ATTTCAAACGCCAAGCCTTTAAC	165	213
	IPO_02158_R	**GTTCATCGAAAGCGATGTTCTC**		214
IPO_02159	IPO_02159_L	GCCTATTTGGACCGAAGAAGAC	394	215
	IPO_02159_R	ACTTCTTGAGGCATCTCGGTTT		216
IPO_02160	IPO_02160_L	GCAGCATTGATGACAAGTTCC	339	217
	IPO_02160_R	AGTATTGGTAAAGGCGTTGCAC		218
IPO_02162	IPO_02162_L	AAGGCTAAGGGGGAGTAAGTCAT	548	411
	IPO_02162_R	**AGGTAGTTGCGTACTTGGTCGTA**		412
IPO_02163	IPO_02163_L	**AGCAACCGAAGATATCGACCT**	284	219
	IPO_02163_R	GCCCAAGCGAAATCAACTCTT		220
IPO_02165	IPO_02165_L	CTTTCCCAGTCAATACATTCCAG	220	221

(continued)

Gene name	Primer name	Primer sequence (a)	Product size (bp)	SEQ ID NO : 1
	IPO_02165_R	CGTTATCACATAAGCCACATCAA		222
IPO_02166	IPO_02166_L	**AAACAACACGCTGTTGAGCAT**	195	223
	IPO_02166_R	CTTCTTTGCGCACCAATAATC		224
IPO_02923	IPO_02923_L	**GCGCAAATTAAACACTACAAAGG**	225	413
	IPO_02923_R	ATCCCCAATCTCCTTTATCACTC		414
IPO_02924	IPO_02924_L	GAAGGTAAATCCAAAGGAAATGG	232	415
	IPO_02924_R	AATTGACTTCGGCTCGTATTCTT		416
IPO_02927	IPO_02927_L	AATTCCATGAGTGGAGTGATTTTT	245	417
	IPO_02927_R	**AGATCATGAGCCTCAGCATTATTA**		418
IPO_03123	IPO_03123_L	GAACGGAGCCATAGTGATGAAG	946	419
	IPO_03123_R	AGAGTCGCTAACACAAGTCATCC		420
IPO_03132	IPO_03132_L	AGGGAATCAAATCGCTCATCT	226	245
	IPO_03132_R	AGAAGAAGCCCATGATGACAGAG		246
IPO_03302	IPO_03302_L	**CGTGTATATCGGCAGTCAAGAAG**	227	225
	IPO_03302_R	CTAAGAAATGAAAGGTGGGGTTC		226
IPO_03306	IPO_03306_L	GGATGACTTGTGTTAGCGACTCT	171	227
	IPO_03306_R	**GAATACGATCCTCCACAATCAAA**		228
IPO_03560	IPO_03560_L	**CACGATCATATATGGGTCCAGTT**	173	421
	IPO_03560_R	GGTTCTTTTTGATCGTAGCCTTT		422
IPO_03656	IPO_03656_L	**TCTGTTCCGAGTATCACCTTGTT**	156	423
	IPO_03656_R	CATAGTATTCGCAGTCCAGATCC		424
IPO_03659	IPO_03659_L	GGATGTGGGGAGGTTTATTAGTC	192	425
	IPO_03659_R	**TTCATCAACTCCTCAGGAATCAG**		426
IPO_03742	IPO_03742_L	AAGATATGTGCCAGCTACCACTG	206	427
	IPO_03742_R	**AGCATATACAGTCCCTCGTATGC**		428
IPO_03816	IPO_03816_L	**ATTTCAACGACCTGCATCAGA**	272	429
	IPO_03816_R	CCACACCAGGTTCTTCTTGTTC		430
IPO_04000	IPO_04000_L	GTAAGGTCTGCAAGGACATCATC	179	431
	IPO_04000_R	**GTGGCTGCGATAGAACTTGTAGT**		432
IPO_04001	IPO_04001_L	**GACCATCTTTCAGTGGTGGA**	110	433
	IPO_04001_R	TAATGCCCTAAACTTTCCTGATG		434
IPO_04002	IPO_04002_L	TGTTTGATCTGAGCAAGTTTGTG	250	435
	IPO_04002_R	AGAAACTCATCCGCAAGGTC		436
IPO_04003	IPO_04003_L	GTAAGGAGAAGTGATGTCGGAAC	283	437
	IPO_04003_R	**GTCCTTGTTCTTGAACTGGTACG**		438
IPO_04004	IPO_04004_L	CTTGACGTCTGACAACCAAGTAG	342	241
	IPO_04004_R	ATAAGATAAACAGGTCGGCCTTC		242
IPO_04067	IPO_04067_L	**CATGCCAAGGAACACATCAAG**	203	439
	IPO_04067_R	AAGTATTTGTTGCCGTGGTACTC		440
IPO_04353	IPO_04353_L	AGGTACTCGGCTATCACAATCAC	202	441
	IPO_04353_R	**ATGCATTCTCCATGTATTCCATC**		442
IPO_04521	IPO_04521_L	TGAAGCACTGTCTATCAACCAGA	222	229
	IPO_04521_R	TTTGTCCTAGTCACAGCACTGAA		230
IPO_04523	IPO_04523_L	GACTTCGGCTATCTGGAGAAAAT	217	231
	IPO_04523_R	TCTTAGCAGGTTTAGGCTGAGTG		232
IPO_04524	IPO_04524_L	CATCTTCAAGGATGACTCTCTGG	235	233
	IPO_04524_R	**GAAGAAGTGACCAGGCTGAATTT**		234
IPO_04525	IPO_04525_L	ACTCAGTGACGAAGAGGTTGAAG	250	235
	IPO_04525_R	ACGAGTAGCTTCAATGGTGTCTT		236
IPO_04526	IPO_04526_L	ACACTATGCCTGCTGACTTGAA	169	237

(continued)

Gene name	Primer name	Primer sequence (a)	Product size (bp)	SEQ ID NO : 1
	IPO_04526_R	AGGTGACTTCAACAATGTTAGGC		238
IPO_04530	IPO_04530_L	GAGACTCGGTTCAACAAGAAAAA	207	443
	IPO_04530_R	**CTTAGACGCACTAGCGAAATACG**		444

a) sequences in bold correspond to part of the oligonucleotide spotted on the microarray

Table 3

Race 3 biovar 2 specific genes clusters

	Oligo ID	Gene ID	SEQ ID NO :	Oligonucleotide sequence
1	IPO1609_0648	IPO_00030	247	GGCTCGAACAACTTGGAGAGATTTACGGAGGAGACGTGTCATTGCTCATGCCGAATTCACGCTACGCCGC
1	IPO1609_0647	IPO_00031	248	CCGGAGGAACCGCTGCGATGGACGCCATCACTGGAAAGTCTAGTGGCCGAACCGCGAAAGCGCGCGCATG
2	IPO1609_0644	IPO_00043	249	GTGACGATACCGCTGTTGCGTCTCTGTCGTTTGTTGTCCAAGAGGGCTTCAAACCAGATACGTTCTCCGC
2	IPO1609_0643	IPO_00044	250	GCGAACAATGTCACCGTCGCCTATGCAGAAGCGTTGCTTGTTGCCACGCCTGCCTCTCGTCTTGTTGATG
2	IPO1609_0641	IPO_00045	251	CAAGGTCTTTGACGAGATCGTTGGAAACATCAAGACCATTGGGCTAAAGAAGCCAATCACCGTCACGCCG
2	IPO1609_0642	IPO_00045	252	GACGAGAATTTCGTCAACCTTCTGCGAGCGGAATCTTTGGCGACACTTCCCAAATATCTGGCTGAGCGTG
2	IPO1609_0640	IPO_00046 *	253	CGCAACCGTGAGGGAGGTGCTCACCAACGAGAAATACATCGGCAACAACATCTATAACCGTGTGTCGTAC
2	IPO1609_0639	IPO_00046/00047	254	GCGCCTGGTTGTCGCGATAGTCGTCATCAGAGCGCAAGTGCTGCTGTTGCCACCGTCGGCGACGTTGGCG
3	IPO1609_0625	IPO_00232/00233	255	GGTGCGACGTTCTTCTCGGCTCCAGATAAGGCGGTCCTGCTACTGTCGTTCAGATATCTCACAGACGACC
3	IPO1609_0626	IPO_00232/00233	256	GGCTGTGAGTATGTTCTGAGGGTAGCCGCGCATCATCGTCCCGAACCACGTTCGTCAACTGGTAAGTTGG
3	IPO1609_0624	IPO_00233	257	CCTGGTTGTGCTTGATAACCATCTGAACGTTGGAATGCAAGTGCTGGAAGACTCGCTATGCAACTGGCAG
3	IPO1609_0623	IPO_00234	258	CGGAACTAGGCACATACAAGCACGCCGTCGGAAGCCTACATTTGTACTCGAAGAACACGGACCAGGCGAC
4	IPO1609_0267	IPO_00874/00875	259	GCAGGATAAGAGCCGTGAGGTTCCTGTTCATCTGCGTAATGCACCAACAAAGCTCATGAAGGAACTCGGC
4	IPO1609_0266	IPO_00875	260	GAGCGGTTCCTTGAAAGCTATGCTGGAGCCATCATCACTGATCCTGCTACGGCGATTGTGGAGCTTGTCG
4	IPO1609_0265	IPO_00875/00876	261	GTCTTCATCAACCACATTGAAGTTCACGACAAGCCAGCGGCAGACAACATCAGGAACATTGTGTTCGGCG
4	IPO1609_0272	IPO_00876	262	CTGCCTATCATCCTGGATAGAGGGCGAAGCCGAACCTTGGAGCGCACAGTCAAGGAAGGCTTTGAACATG
4	IPO1609_0271	IPO_00877	263	CGGCTACAGGCAGTCTCAAAGAGACAGGTCTGAAGAAGACTATGCCATCTATTCGGTATGTGGCTGGTGC
4	IPO1609_0270	IPO_00878	264	CGTTGAACATGTGGATGGTAAGCACGGAGGTAAAGTCAGGCAGTTGATTAGACTGATCAAGGCATGGAAG
4	IPO1609_0269	IPO_00878/00879	265	CGCTGGTGCTGTGGTGGGCTCCCAAGTGAGTAAGAGCAGTGAAGTGAAGAATGTCACTGACTTGCAAGTG
4	IPO1609_0268	IP_00879	266	CCAGCAATCCCACTAATGTTTGTGCTACTGGTCAGTCCTACGGCTTCAACTTCGCCAACAATCAATACAC
4		IPO_00880 *		no representative oligonucleotide on the micro array
4	IPO1609_0659	IPO_00881	267	GGAGGTTTGGAGGCTCAGATCGGTGGTTTGTCCATGCAGTATCACAACCTGCTGTTGCTGCTGGCTGGTG
4		IPO_00882 *		no representative oligonucleotide on the micro array
4		IPO_00883 *		no representative oligonucleotide on the micro array
4	IPO1609_0151	IPO_00883/00884	268	GCTGTAGCACCGACTCTGACCGCCAATGACGAAGTTCTATTGAACTTCATTAGTGAATACGGTGATGGTG
5	IPO160_0141	IPO_01057/01058	269	CGTCTTGTGCCTATAGCAATGAAATGCAGAAGGCTTGGCGGACAATATCAACTATGCCAGCTCGTGGTG
5	IPO160_0135	IPO_01058	270	ATCATGGCTGAGATCCAGCGTATTGCCGCAACCGAGCTCATCGTTATCGACATGGGCGACAGGCTTGGCA

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6	IPO1609_0124	IPO_01130/01131	271	GAGGTCAAGCTGGATCAAGCTGGAGTCGAAGTGGAGGAAGCGAAAGTCCACAAGTTCAGCAAGAACGATC
6	IPO1609_0123	IPO_01131	272	CCACGATCAACTACTACCGTGTATCGACCAAGGATCAATCCATCGAATCCCAGCGTCAGAAGCTAGGCCC
6	IPO1609_0122	IPO_01132	273	CATCAACGACCCTTACTGTCCGAGTAACTGCCGATGGGCCACCAACAACGATCAGCAGAACAACAAGCGG
7	IPO1609_0159	IPO_01258/01259	274	GACCGACTGGAACGAGATGGCCAAGGCTCCGAGCAAGGTGGCAAAGATCGCGAAAGCAGTGGGACTCGAC
7	IPO1609_0160	IPO_01258/01259	275	CTTCATGACGGTGTAGCCGTGACCCAGGTGTCTGACCTTGATGCGCGACTAAGCGCACACTTGATGCTCT
7	IPO1609_0161	IPO_01259	276	GCCGGTGAAGATACGGGTCAGCGTCTCAAGCAGGCGCGTGAAATGCTCAAAGACAAACAGATCTTCGCGG
7	IPO1609_0386	IPO_01260	277	GCCACATCGAACTGTGGGCCGACGGCATCTCCCTGCCCTATGTCCTCTATGACCGGCTTTGCGAGATCGA
8	IPO1609_0167	IPO_01311	278	GGAGAACCTCGACAACCAGACCATCTACAAGATCCTAGTCAAGTGCATCAAGAAGGCGAAGGAGAGGCGG
8	IPO1609_0168	IPO_01312	279	GGCAGATGGACATGAATCTTCCTCTTGAATTTCACGTCCGCATTGAGGAGAC
8	IPO1609_0169	IPO_01313 *	280	GTGCCACTAGCTATTCGTGCGAGTCCCTGGCAGAGATATTCAGACGGCTACACCAGCAGGCTGGCATCGC
8	IPO1609_0170	IPO_01314	281	GCGCTGCCGCCGCTGGCTCGGGCGGCAATCGACCGCTACCTGGTTGAACGCGGGCTACCGATTACGCGCG
9	IPO1609_0216	IPO_01877/01878	282	GAGAAACATCCCGTCGCCATGCGCCGCATGTTGCTGGTTGCCGCAACCGTCACGCTGCTATCGCTGACTG
9		IPO_01878 *		no representative oligonucleotide on the micro array
9	IPO1609_0217	IPO_01878/01879	283	CGTTTCGTGCATACATCGACAGCCTTGACCACTACACTGACGCCCATGTGATTGTCCTTCCGTATGCGCC
9	IPO1609_0218	IPO_01878/01879	284	GATATCTGGCAGGCATTTGCCAACCCAGACGAAGATCGCTTGCGCTACTTCAAGAAGGCCACTGATAAGG
10	IPO1609_0244	IPO_02090	285	GACGTCAAGCTGCCTATCGGGCAGGTTTGCCCAGTGTCGTTGAACATCCTTATCAAGGGTGAGTCGGGCG
10	IPO1609_0245	IPO_02091 *	286	CTTGACCGATACGTCAAGGGCAGCCGACTGCCGACATATGCAGCGGCACTCATCCTGGCGAAAGAAGCGG
10	IPO1609_0246	IPO_02092	287	CGCAATGCATCCTCACCGAAGGTGTTGCTGACGCAACTGGCGGCGTCTCCGAACAGATCAAGGTTGGCCG
10	IPO1609_0247	IPO_02092/02093	288	CGTTCAGGAGGTCGTCATGGTCGATCCGAACGACAAGTACACGATGCAGTTGCCGCTGATGCGTTATCGC
10	IPO1609_0248	IPO_02093 *	289	GGGCTCGTGCGTCAATGCTTTGGTTATGGCGCTGTTCGTTCTGCTGCTGACGCTGTTGGTCCCGGCGTGG
10	IPO1609_0249	IPO_02093/02094	290	GAGGCGATGGACGACGCTGAGGCTATCGAGTTCTTCGGCAGCCTGGATGAGCGTGATGAGGCGATTGAGG
10	IPO1609_0250	IPO_02094 *	291	CCACAGAGCTGCAGCGGCTATCTGCTGTTGCAGCCGAGCGAATACTCGAACGTGATGGCTCTGTCCGGCG
10	IPO1609_0251	IPO_02095	292	GGGTGCTGCGATGGCGCAAACCACGACCAGCGGTATCGATTTCTCGTCCATGACGGGTGCCGTGAGCGCG
10		IPO_02096 *		no representative oligonucleotide on the micro array
10	IPO1609_0252	IPO_02097	293	CGACAGTGTCTTCGTCGCTATCTTCACGGCGCTTTGGCAGATCTCAGAGGATCTGTTCATCGACTCGCTG
10	IPO1609_0253	IPO_02098	294	CGAGATTCCTGAAGCTGAGGTGCTGCGTTGGAATGAGCTGGTCGAGAACGACAGCCTGGTCATCTTGGAC
10		IPO_02099 *		no representative oligonucleotide on the micro array
10		IPO_02100 *		no representative oligonucleotide on the micro array
10	IPO1609_0257	IPO_02100/02101	295	CGCCGCACTGCATTGACCAAGCTCATTCGTCAGAAGCGATCTAACAACTTTCAGATTGCCAAAGAGATGG
10	IPO1609_0258	IPO_02100/02101	296	GGAACAAATCAAGATGTTCAACTTCACGGCTGATGAACTTGGTTTCCATGCTGCTCCTGATGCACGTGCC
10	IPO1609_0259	IPO_02100/02101	297	CTGTTTACCAACCACATAGCCTCACACACGGCTGCTGACGGATCAGACTTGGACGACTACTTGAGTCGTG
10		IPO_02101 *		no representative oligonucleotide on the micro array
10	IPO1609_0060	IPO_02102	298	GGTGGTCGAGGTGAGAAGTGTCTACGACAAACCTGTGAAAGCCGTTGAGAATCGAATATTGGCAATCAGG
10	IPO1609_0159	IPO_02103 *		no representative oligonucleotide on the micro array

10	IPO1609_0061	IPO_02103/02104	299	CGTCATTCGTGAGAACCAGATCAAAGAGCTTCTGATTGCTTACAACAGCTACTTCATGGTGGCTGCTGCC
11	IPO1609_0065	IPO_02140	300	GAAGTATGCTGGCCTGATCGGTCAGCTCAACTCAGCCGCTAGGGAAACGCTGATTTATCAGTCTCAGCCG
11	IPO1609_0066	IPO_02141	301	GCGTTACCGCATGGAGGCTACTGACGCAGCAAACCTCAAGAATCAGACCGTTACGTTCCAGATTAAAGTG
11	IPO1609_0067	IPO_02141/02142	302	CCGGATAGCCGCCATTGGCAGCACGGTCGGCAACCGGTTGTGGAGCCATGACGCGCCAACGCTGATGTTC
11	IPO1609_0068	IPO_02142	303	GTCAATGGCACCTTGACGGTAGGCGACGCGGGAATCACGGGCGGCGCTGAAGACGAGAGCGTGGACGATT
11	IPO1609_0069	IPO_02143	304	GCCTTGTAGTCGGCGCGAGCAAGGTGCAGGTGCGCGTGCTGGACGAAGAGACGTTGGACAACATCAACCG
11	IPO1609_0070	IPO_02144	305	GCTTGGTCGTGAGCTTGTGGACTGCCAGTATTCCAAGACGCTATCCGGCCTGAAACTGAGCGAGATCGTG
11	IPO1609_0071	IPO_02145	306	GCGCTGTCTGGTGTTGCCTCAACGGATGGTGCCGTGCGTCGCAATCTGCTGCGCGAAGAAGCGTTGCGCG
11	IPO1609_0072	IPO_02146	307	CGGTGTTGGTGCCGCTGTCGGTGGCGGTCTGGGCTTAGCCTGGGAAGGTCTCAAAGACCTGCTGAAGCCA
11	IPO1609_0074	IPO_02147	308	CGCCGGCCGACATCGAAGCGAACATCGCAAGCGAGCATTACTTCACTGCCGAAGACGGCATGATGGCCGG
11	IPO1609_0076	IPO_02148	309	TTCCTGCTACATCAAGCGGCTGATTTCCATGTACCTGCATCGCTCCGATGGCAGCACCGACGACGCCTAT
11	IPO1609_0077	IPO_02149	310	CGTCGGTGGCCAAGTCCTGGAGTACACCGACGGCGATTTGTACTGGCGCGATCGCTACGAGTTCGACGCC
11	IPO1609_0078	IPO_02150	311	CCGCATCCGATGATCCGGTTCCTTCTGATGATCTGGCCATCATCGAAAGCGCACCGCGCCGCTTTGGCCG
11	IPO1609_0080	IPO_02151	312	CGGAAGACTGGAAGAAGATCGCCAAGCTAGTCACCAGTACCGGCAAATCCAACACCTACGAATGGCTGAG
11	IPO1609_0081	IPO_02152	313	GGTGAAGTGCTCGAAATCCTTTCGGTCGCACTCACCAACACACCCGCCCTGGATGGGCTAGAAGCCGTGG
11	IPO1609_0082	IPO_02153	314	CGCCGAGTGGTTCGCGCTCTACCGCGATGATGGCGCGATTGACGACTGGACGTTTGTGAGTGGCGTGCGG
11	IPO1609_0083	IPO_02154	315	CATGTTCCTTGTGGTGGCACTGCTGCTGGCGATCTTGTCAGTTTGGCTGTTCGACCGCTACGTGTGTCGG
11	IPO1609_0084	IPO_02154/02155	316	CGTGGTAGACGCCTACCCGGCTGTCGATGAAGATTTGCTGAGAACCTTGCCACCCGTGCTGCGTGCGGTG
11	IPO1609_0085	IPO_02155	317	GCGCGTCAAGTGGGCCGTCACGTGCCGGACTTGGACAGCTTGGCCGTAGCTGAATGCCAAACGATTGCCG
11	IPO1609_0086	IPO_02156	318	GCAGACATGTTCTGCGAAGGATGGGTGTTTGCCGTGCGCGAGCTGGTGGGTGCCACCGTGCCGCCCGAAG
11	IPO1609_0087	IPO_02157	319	GACCGAAACCATTCTTGACACCGTGCGCGCCGGTAACGAGCTGACGATCACCGACCTGGGCAAGTTCGGC
11	IPO1609_0088	IPO_02158	320	TCACCTTGAGCACGTTCGACGGTCGCCAGCAGGTAGTCGTGTCCCAGGCCGAGAACATCGCTTTCGATGA
11	IPO1609_0089	IPO_02159	321	CCGCTGCCTGAAGTCGTCTGCCCGAACTGCCGCGTGCGGATGAGCCTGGATGTGGTGCTAGCCGATGACG
11	IPO1609_0090	IPO_02159/02160	322	GAAACAGCTAGCAGGCATCACCCAGGGACCTGTTGCAGCCGAACTGCTGGCGGGCTTGCGCCGAATCTGC
11	IPO1609_0091	IPO_02159/02160	323	CGCTTCTTGGATGCCATCGCCAACGGCGCACCTTCAGCAGAGGCAGCCGCGTTTGGCGCCTGGATCGAAG
11	IPO1609_0092	IPO_02160	324	CTTCGCAACACCGACAGTCTGCTCATCGTGGATGAGGCCGAAACGCTCACGCCGCACCAGCTCCACACGC
11		IPO_02161 *		no representative oligonucleotide on the micro array
11	IPO1609_0093	IPO_02162	325	CGCTGTACATCGCCGCCTGGCGGAAGTGGACGGCTTCGCGGTCAGCTACGACCAAGTACGCAACTACCTG
11	IPO1609_0094	IPO_02163	326	CAAGCAACCGAAGATATCGACCTGGGCATCACGGAAGGCGCTCTAGTTCACGCCACGCAGACGGACGACG
11		IPO_02164 *		no representative oligonucleotide on the micro array
11	IPO1609_0095	IPO_02165	327	GCCGACACGACGAAGCAAACACAGCACGCATACGAAACCGACCGCACGCCGCCGAAAGCCAGCTATCTGG
11	IPO1609_0096	IPO_02166	328	GGCGATCTTGGAATGTCAGACCGTGGCAAACAACACGCTGTTGAGCATCAACGGCATGAACAAGCGTTTC
11		IPO_02167 *		no representative oligonucleotide on the micro array
11	IPO1609_0097	IPO_02168 *	329	GGACTGGGCCACTGGCAACAGGAAGCGGCCACGGTGCGGCCTGCGCTGAACCGCGCAACCATCGATAGCG
11	IPO1609_0098	IPO_02168/02169	330	GTCGCTAGCTGGATCAACCACGCCAAAGGCCAATACGAAATCTGCCGGGCTCGACTCGGCGCACTGATCG
11	IPO1609_0099	IPO_02168/02169	331	GGAAGGTCTATCACGATCATCTCAGTGACCCTAACAAGAGGCCACCAGCGAACCTGGAACTTGTTGCTGC
12	IPO1609_0028	IPO_02922/02923	332	CGCACTTACCTCGACGCCAGCATTGAGTCATTGGATCGCCACATTAAGCTGCTGACTAGCCTAATCGAAG

12	IPO1609_0027	IPO_02923	333	CAAATTAAACACTACAAAGGGCTGGTAGTTTATGCGCCTCTAATCGCGCTATCTGTGGTCTTTGTGGCCG
12	IPO1609_0026	IPO_02924	334	GCGGTGCTTGCCTTGTCTGGCGCCAAACGCTTCCAGCACTTCATCAAGGTCGTTGCAGATTGGCAGGAGG
12	IPO1609_0025	IPO_02924/02925	335	ACGCGAATAAGGCATCGCTACCAGGTGACGTAAGCCGGGTATATAGAAATGCTTTAGACATGATCTGGAG
12	IPO1609_0024	IPO_02925 *	336	CTATCGGTTCCGCTGCGCACATGGGCATGAAACGTCCCGCACCGGCGACTACGCCCTCCGTAGTCTGATC
12		IPO_02926 *		no representative oligonucleotide on the micro array
12	IPO1609_0023	IPO_02927	337	CTTCGCTAAATAATAATGCTGAGGCTCATGATCTTCTATACTCGCTGCTTGCCCATGACAGTGAGGCGGC
12	IPO1609_0022	IPO_02927/02928	338	GACATTGCAGCATCCGTCTTGCGTGACATTGAAGTCGGCAAACACGGCTTAATGTCGGCTTCGGCGAGCG
12		IPO_02928 *		no representative oligonucleotide on the micro array
12		IPO_02929 *		no representative oligonucleotide on the micro array
12		IPO_02930 *		no representative oligonucleotide on the micro array
12		IPO_02931 *		no representative oligonucleotide on the micro array
12		IPO_02932 *		no representative oligonucleotide on the micro array
12		IPO_02933 *		no representative oligonucleotide on the micro array
12	IPO1609_0020	IPO_02934 *	339	GTGCGCAAACAAGGCACGCGGCGAAGCGTCTCTGCGCAAAGACGGATTGGACGAACTGCGCCGCATCGCG
12	IPO1609_0019	IPO_02934/02935	340	GGCCGGAGACATCTTTGCGTTCCAGTTGGAGCAGTTTCCGGATCGGTACTTCTTTGGGCGAGTCGTGGAC
13	IPO1609_0524	IPO_03302	341	CAGCGGACGAGCAACGATAGGTTGCTTCACGACGATCTCGGCGCGTGTATATCGGCAGTCAAGAAGTTCG
13		IPO_03303 *		no representative oligonucleotide on the micro array
13		IPO_03304 *		no representative oligonucleotide on the micro array
13	IPO1609_0522	IPO_03304/03305	342	CGTTGGGAAGACAAAGAGAACGTCTTTCTCTACGCATCAGGATTTCTTGCCGCAATGGATTTCCTCAGGC
13	IPO1609_0523	IPO_03304/03305	343	CGCGGGCGTCGCTTGCCCTCGGTGGCGTCGGGATCTTCTATTCAAGAACTACGCCCTATTCGTGGCGGGC
13		IPO_03305 *		no representative oligonucleotide on the micro array
13	IPO1609_0521	IPO_03306	344	CAAGGCAATTTGATTGTGGAGGATCGTATTCAGGTTCACATGAGCTTGCGACTTCTGCATATTCCAACGG
13	IPO1609_0520	IPO_03306/03307	345	GTCGGGTTGTTGTACCTCTACGGCGAGCAAACCGGTCATCCATCAGCGGCTGGTGGCGCTCTACTGCTGT
14	IPO1609_0457	IPO_03656	346	CGAGTATCACCTTGTTGAGGCTCGATCAGTTACTGAATGCCGCCTATGCCAACCTGTTGACCAAGATGCG
14		IPO_03657 *		no representative oligonucleotide on the micro array
14		IPO_03658 *		no representative oligonucleotide on the micro array
14	IPO1609_0456	IPO_03659	347	GATGGCATGGCGAACCATCACCTGATTCCTGAGGAGTTGATGAAACATCCTCGATACGCGGCGATGTTCC
14		IPO_03660 *		no representative oligonucleotide on the micro array
14	IPO1609_0455	IPO_03660/03661	348	GGCTTGAAATGGTGGAGATTCAACTAGACAAGCATGGCCGCGCTGCCTTTCGTCTGAACATTGGTGTCGC
15	IPO1609_0435	IPO_03741/03742	349	GCCACACAGCTTCTCGGCGGCTCAATGCGGTCGTGTGTCTCTTGAGATCGCTGACAGAACGCTCAGGGCG
15	IPO1609_0434	IPO_03742	350	GTGCATACGAGGGACTGTATATGCTCTCGTGCATGGAAACACTCACAAAGGAACGCGCCGACCACTTGGC
16	IPO1609_0420	IPO_03816	351	CAATAGCCTTGCCAAGCACTGCAACATGAAGGCGGTCACGGATTTCAACGACCTGCATCAGAAGCAACTG
16	IPO1609_0418	IPO_03816/03817	352	GCGGAAGTGTGGGCAGAAGGAAGCTGTTGAGTATATCGCTGATTTGAATCGGTATACGACGCTTCGACCG
16	IPO1609_0419	IPO_03816/03817	353	CGATCACTTCATCGAGCTATCAAATATTGGTGAAGAAGATCGTTCAGTGGAGGCAATGGCGGTTGGGATG

17	IPO1609_0383	IPO_03999/04000	354	GTTGGTGAGCGAAGCGCAGATGCGTGCCGCTGGTGAAGCGATCTATGGTGAACGTAAAGTCGTTACGTGC
17	IPO1609_0382	IPO_04000	355	CGTCGTGAACACCTCGGTTCGCAAGTACGACAAGAAGTACTACAAGTTCTATCGCAGCCACACCAAGAGC
17	IPO1609_0376	IPO_04000/04001	356	CGGCGTGATCGGCGTTGCGATCATCGGTATCTGCCTCGGTTTCAAGGCGATCGACCTGGGCAAGCGCGGC
17	IPO1609_0377	IPO_04000/04001	357	GCGCTGGTGGCTCTCTTCTACGCGTTGGTGGCCATGATCGGTGCTATCAGCGCGCTCGTCTTCATTTGGG
17	IPO1609_0378	IPO_04000/04001	358	GCCGCAATGGAGGTGTCGGCCATTGGTATTGCGGATATGGCTGCTGTTGTGGCGCGTGCCTCTACGCCGG
17	IPO1609_0379	IPO_04000/04001	359	GGCAATTACGGTGTTCGCAGCATCGACGTGCCGTGCTCGTTGTTCCAGACCATCGGTCTGATCATTCTGG
17	IPO1609_0380	IPO_04000/04001	360	GCTGCTATCTCGGCGTTGATCGCCAAGGTTGTCGGGCTGGCTACTTGGTTTGGGCAGCTCGCGATTGCCG
17	IPO1609_0381	IPO_04000/04001	361	GATCTGATTGAGCGGTTGACGGAATTGGCGTTCGGCTACGCCGCTGAGATGCATTACCACCAGGAGAAGG
17	IPO1609_0375	IPO_04001	362	CTGCTGCACTGCTGAGCAGTTTGCCGTGATCGGGATCGATGGCCCGACCATCTTTCAGTGGTGGAGCTGG
17	IPO1609_0374	IPO_04002	363	CTGCTTGTGATGGTCGTAATGGCGAGTCGGGTGGCGTACTGGGAGCGGCGTTTCTGGCAGTCGCTGGTCG
17	IPO1609_0373	IPO_04003	364	GGTGGTTATCAGCGCAAGGCGTACCAGTTCAAGAACAAGGACACCGGCGAGGTCGAGACGGTCACGCCGG
17	IPO1609_0372	IPO_04003/04004	365	ACAGCGACAAGCTCCAGTACGACTTTGGCAAGCATCCGCGAGTGGATGAGGTGACGGACGCCTATTTGGA
17	IPO1609_0371	IPO_04004	366	GACGCAATACCGCAAGGGCGACCGCAAGATGGACAACGAAGCGTGCCTGCGCCTGGCGCAACTGCTCGAG
18	IPO1609_0264	IPO_04521	367	CGGCGTTCTACCAGCCAAGGAAGTGCTTTCCACTGCGAGATCTGTAGGCACATGGACATGGAGACACAAG
18		IPO_04522	*	no representative oligonucleotide on the micro array
18	IPO1609_0263	IPO_04523	368	CGGCAGCACTCATGCCAGCGGGTTCATTGCCTCTCTACGTCCCAAGCTCAACTTCATTGTCACTGATACG
18	IPO1609_0262	IPO_04524	369	CGGCGTTCGTGAGGTACGTGGCTTCACTGGTGAGCAGCAAATTCAGCCTGGTCACTTCTTCATCCTCCAC
18	IPO1609_0261	IPO_04525	370	GTGGTGGATTCGGTCATCAAGAATGGCGAGATCAAGCAGGAAGGTGACAAACGCTTTGTTCGCATGGCCG
18	IPO1609_0260	IPO_04526	371	CCACGAACTGGATGTGGTGGTTGAGCAGTGCTACCAGATTAAGCCGTTCTACAGCGATACCGAACGCTTG

Race 3 biovar 2 specific individual genes

	Oligo ID	Gene ID	SEQ ID NO:	Oligonucleotide sequence
19	IPO1609_0147	IPO_01025/01026	372	AGGCTATACGGACAGCACAGCCGCAAATTATGCCTGCCGACTGGGAGGTGAAAGAGGTTGGTGGCACGTT
20	IPO1609_0146	IPO_01030	373	ACATGTTGTTTATCGGTGGATATGGCTGGGATGGCTCGAATCTGTATATTGAAATTAATACAGGAAAGGT
21	IPO1609_0185	IPO_01362	374	CAATTGGGTATACGTGATCTGTGGGTGCCTGATGGGATTCGCGTTCGGCTGGATTGCCATGCTCTGGCTC
22	IPO1609_0233	IPO_02072/02073	375	GCGGTAGCCGACTGGCACACGTATTTGGACGGCGTTGGCCGGGAAGATTTCCCTGACCAACCAGACGATC
22	IPO1609_0234	IPO_02072/02073	376	CAGCCATTCTCTTCCAACTTTATTTCTACTGGATGGATCGCTATTACGTGTTTGCGCCGATGTGGAGCTC
23	IPO1609_0111	IPO_02448/02449	377	CTTGAACCAAGCATAGAGCGCGTCGCATATCGCCAGGCCGTGTTCAAGCGTGACCTGATCATCGGTAAGC
24	IPO1609_0563	IPO_03105/03106	378	GCCTATCGTCAACATGGTTTCCTATGTTGCTCAGAAGTCAGCGTGGAATATGCTCAATTTGAACGTGCCG
25	IPO1609_0508	IPO_03123	379	CGCGTGACCAAACGCCAGCGCTTCCTGGCAGAGATGGAGAAGGTCTTG
26	IPO1609_0557	IPO_03132	380	CAAACATTGCCTTCACGGAAGATGAGCAGCATCTGTACAACCTGACGCTTGATGAGCTGGGCGACGAGTC
27	IPO1609_0420	IPO_03433	381	CAATAGCCTTGCCAAGCACTGCAACATGAAGGCGGTCACGGATTTCAACGACCTGCATCAGAAGCAACTG
28	IPO1609_0313	IPO_04287	382	GCCGGTTGCTGACGGAGATCGAGAGGCTGGCGGATGACTTTAGGGAACCGCTGATCAATGAAGTCGGCGA
29	PT04834A	IPO_04353	383	CACAACCCTGCGCATTTCCGCGCCGAACTCTTGATGGAATACATGGAGAATGCATCCCCCTCAAAAAACG

30	IPO1609_0254	IPO_04530	384	GATATCGCGGACATAAGATGCTTCGTCGCCCTCGATGGCTCGTCGTATTTCGCTAGTGCGTCTAAGGCTG
31	IPO1609_0021	IPO_04923	385	GTCCAGACCTGTCTGTCACACTTGCCTACCAGCAGTCTTACAACGACTACGGATCGAATGTCGGCATCGG
32	IPO1609_0018	IPO_04926	386	GGTCGCCACATTCACATTGATGGCCCACTCGACGTATTGAACAAAGTTCCAGGCATTGATCATTGGTGGA

Table 4

Clusters	SEQ ID NO:	Gene ID	SEQ ID NO:	L_PCR primers	SEQ ID NO:	R_PCR Primer	SEQ ID NO:
2		IPO_00043	50	CTGAATTCGAAAAGGATAGAGCA	141	CTCGACAAACTCTTGCAACTGAC	142
2		IPO_00044	51	**CTATGCAGAAGCGTTGCTTGTT**	143	CTTTAGCGAGCACAAGATTGAGT	144
2	1	IPO_00045	52	**GAGATCGTTGGAAACATCAAGAC**	145	GTGAACCACTATTGCCGGTATC	146
2		IPO_00046	53				
2		IPO_00046/00047	54				
3		IPO_00232/00233	55				
3	2	IPO_00233	56	AGAACTGCCAAGTTCGACTACCT	147	**CATTCCAACGTTCAGATGGTTAT**	148
3		IPO_00234	57	GCAGAAAAGATATCCCCTGCAC	149	**TTCGAGTACAAATGTAGGCTTCC**	150
4		IPO_00874/00875	58				
4		IPO_00875	59	GATCAGATGGAGCAAAGAACACT	151	TATTGAAACTCTTCACGGGTCAT	152
4		IPO_00875/00876	60				
4		IPO_00876	61	TTTCGACCAAGAAAAGCATAGAG	153	ATTTCTGTGCCCACTACGAACTA	154
4		IPO_00877	62	TGGTGTTCTAACTGTGGAAGGTT	155	TACCGCCAGTCATATCAGTTCTT	156
4	3	IPO_00878	63	**ATTAGACTGATCAAGGCATGGAA**	157	CCTTCATTATTGAGACGGTCAAG	158
4		IPO_00879	64	**ATGTTTGTGCTACTGGTCAGTCC**	159	CCTTCACTTGCAGATAATGGAAC	160
4		IPO_00880	65				
4		IPO_00881	111	AAAGAAGCTCAAGGAGATCAAGG	161	**AACAGCAGGTTGTGATACTGCAT**	162
4		IPO_00882	112				
4		IPO_00883	113				
4		IPO_00883/00884	66				
5	4	IPO_01057/01058	67				
5		IPO_01058	68	**CGAGCTCATCGTTATCGACAT**	163	AAGCTCTTGGACTAGGACGATCT	164
7		IPO_01258/01259	69				
7	5	IPO_01259	70	**TGAAATGCTCAAAGACAAACAGA**	165	ATCGTACAGGTCATTGCCAAAT	166
7		IPO_01260	114	TACAACCTGAAGAGGATCTCGAA	167	**AAAGCCGGTCATAGAGGACATAG**	168
8		IPO_01311	71	**CAACCAGACCATCTACAAGATCC**	169	GCTTCATACTCAAATCGAACACC	170
8	6	IPO_01312	72	AACTCCAACTTGCTTGACTGTTC	171	GGATGAACTTCGTTCGATTGAG	172

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8		IPO_01313	115				
8		IPO_01314	116	GAAGCTCGGTGATATCGAAAC	173	GGTGATCGCTGTCGATAATTT	174
9		IPO_01877/01878	73				
9	7	IPO_01878	74				
9		IPO_01878/01879	75				
10B		IPO_02100/02101	76				
10B		IPO_02101	77				
10B	8	IPO_02102	78	GTATCAGAAAGGCCAGCTACACA	175	**CTGATTGCCAATATTCGATTCTC**	176
10B		IPO_02103	79				
10B		IPO_02103/02104	80				
11		IPO_02140	81	AAGGGCAATGGCTTTTTCTGT	177	**GAGACTGATAAATCAGCGTTTCC**	178
11		IPO_02141	117	GCTTTCTACGTCGCCTCAGTAT	179	**GTAACGGTCTGATTCTTGAGGTTT**	180
11		IPO_02141/02142	118				
11		IPO_02142	119	CCACTACCCCTGTTTCCATTC	181	AAACCTGTAGTCGTCGTCCTTG	182
11		IPO_02143	120	**AGACGTTGGACAACATCAACC**	183	AGTTCTGTTCGTCGTCGTGAAT	184
11		IPO_02144	121	**CCAGTATTCCAAGACGCTATCC**	185	AACGGATACAGCAGCAGGTTT	186
11		IPO_02145	122	ATACCCAGCGCGTATTCCAA	187	**GTTGAGGCAACACCAGACAG**	188
11		IPO_02146	123	CTTGAGAAAGCTTTTGGTGAAGA	189	**CTTTGAGACCTTCCCAGGCTAA**	190
11		IPO_02147	12'	TAAGAGCAGGCTATGGACAACAT	191	AATACCAGCACACAGAAGGTCAG	192
11		IPO_02148	125	**CTGATTTCCATGTACCTGCATC**	193	ACATCAGCACGTTCTTGTAGAGC	194
11		IPO_02149	126	GACGATGAGTTGCTGAAGTACC	195	TGAAGGTAATGGTCACAGCTTTT	196
11		IPO_02150	127	**ATCCGGTTCCTTCTGATGATCT**	197	CTTCAACTTCACGTGTTCAATCA	198
11		IPO_02151	128	GCTAGTCCACACGACAAAATCAT	199	**GTGACTAGCTTGGCGATCTTCT**	200
11		IPO_02152	129	**AGGTGAAGTGCTCGAAATCCT**	201	CTTCTTCCTTCTCGATGCCTTC	202
11	9	IPO_02153	82	TTATGTGGCTTTCTCTGGCAATA	203	**ACAAACGTCCAGTCGTCAATC**	204
11		IPO_02154	83	CATTTATCTCTGGTCTTGGCTTG	205	**ACAGCCAAACTGACAAGATCG**	206
11		IPO_02154/02155	84				
11		IPO_02155	85	GCATGAAAATGTCTACGTTCCTC	207	ATGGTGATAGTGCGGAATGAC	208
11		IPO_02156	86	**CAGACATGTTCTGCGAAGGAT**	209	GAGGAACGTAGACATTTTCATGC	210
11		IPO_02157	87	TGTAATGACCAAGCAAGAACTCA	211	**CACGGTGTCAAGAATGGTTTC**	212
11		IPO_02158	88	ATTTCAAACGCCAAGCCTTTAAC	213	**GTTCATCGAAAGCGATGTTCTC**	214
11		IPO_02159	89	GCCTATTTGGACCGAAGAAGAC	215	ACTTCTTGAGGCATCTCGGTTT	216
11		IPO_02159/02160	90				
11		IPO_02160	130	GCAGCATTGATGACAAGTTCC	217	AGTATTGGTAAAGGCGTTGCAC	218
11		IPO_02161	131				
11		IPO_02162	132				

11		IPO_02163	133	**AGCAACCGAAGATATCGACCT**	219	GCCCAAGCGAAATCAACTCTT	220
11		IPO_02164	134				
11		IPO_02165	135	CTTTCCCAGTCAATACATTCCAG	221	CGTTATCACATAAGCCACATCAA	222
11		IPO_02166	136	**AAACAACACGCTGTTGAGCAT**	223	CTTCTTTGCGCACCAATAATC	224
11		IPO_02167	137				
11		IPO_02168	138				
11		IPO_02168/02169	139				
13		IPO_03302	91	**CGTGTATATCGGCAGTCAAGAAG**	225	CTAAGAAATGAAAGGTGGGGTTC	226
13		IPO_03303	92				
13		IPO_03304	93				
13	10	IPO_03304/03305	94				
13		IPO_03305	95				
13		IPO_03306	96	GGATGACTTGTGTTAGCGACTCT	227	**GAATACGATCCTCCACAATCAAA**	228
13		IPO_03306/03307	97				
18		IPO_04521	98	TGAAGCACTGTCTATCAACCAGA	229	TTTGTCCTAGTCACAGCACTGAA	230
18		IPO_04522	99				
18		IPO_04523	100	GACTTCGGCTATCTGGAGAAAAT	231	TCTTAGCAGGTTTAGGCTGAGTG	232
18	11	IPO_04524	101	CATCTTCAAGGATGACTCTCTGG	233	**GAAGAAGTGACCAGGCTGAATTT**	234
18		IPO_04525	102	ACTCAGTGACGAAGAGGTTGAAG	235	ACGAGTAGCTTCAATGGTGTCTT	236
18		IPO_04526	103	ACACTATGCCTGCTGACTTGAA	237	AGGTGACTTCAACAATGTTAGGC	238

Individual Genes	SEQ ID NO:	Gene ID	SEQ ID NO:	L_PCR primers	SEQ ID NO:	R_PCR Primer	SEQ ID NO:
10A	12	IPO_02090	104	CAATAGAAATTGCCGAGGTGATA	239	**CCTTGATAAGGATGTTCAACGAC**	240
17	13	IPO_04004	105	CTTGACGTCTGACAACCAAGTAG	241	ATAAGATAAACAGGTCGGCCTTC	242
21	14	IPO_01362	106	**AATTGGGTATACGTGATCTGTGG**	243	TCGGGTAAGACGAAGCTGACTA	244
22	15	IPO_02072/02073	-				
25	16	IPO_03123	140				
26	17	IPO_03132	107	AGGGAATCAAATCGCTCATCT	245	AGAAGAAGCCCATGATGACAGAG	246
28	18	IPO_04287	108				
29	19	IPO_04504/04505	-				
30	20	IPO_04530	109				
31	21	IPO_04923	110				
32	22	IPO_02934/02935	-				

Table 5

Gene ID	GenBank Accession number	SEQ ID NO:
RRSL_00004	NZ_AAKL01000174	23
RRSL_00093	NZ_AAKL01000099	24
RRSL_00419	NZ_AAKL01000074	25
RRSL_00442	NZ_AAKL01000066	26
RRSL_00500	NZ_AAKL01000026	27
RRSL_00600	NZ-AAKLO1000073	28
RRSL_00696	NZ_AAKL01000059	29
RRSL_00772	NZ_AAKL01000058	30
RRSL_01930	NZ_AAKL01000033	31
RRSL_01998	NZ_AAKL01000044	32
RRSL_02069	NZ_AAKL01000022	33
RRSL_02232	NZ_AAKL01000025	34
RRSL_02410	NZ_AAKL01000024	35
RRSL_02412	NZ_AAKL01000024	36
RRSL_02430	NZ_AAKL01000024	37
RRSL_03158	NZ_AAKL01000027	38
RRSL_03244	NZ_AAKL01000017	39
RRSL_03346	NZ_AAKL01000012	40
RRSL_03351	NZ_AAKL01000012	41
RRSL_03359	NZ_AAKL01000012	42
RRSL_03472	NZ_AAKL01000008	43
RRSL_03712	NZ_AAKL01000013	44
RRSL_03795	NZ_AAKL01000009	45
RRSL_03985	NZ_AAKL01000007	46
RRSL_04009	NZ_AAKL01000007	47
RRSL_04153	NZ_AAKL01000004	48
RRSL_04507	NZ_AAKL01000002	49

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<213> Ralstonia solanacearum

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aacacctcgt ag 372

<210> 27
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<210> 30
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<212> DNA
<213> Ralstonia solanacearum

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<210> 32
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<212> DNA
<213> Ralstonia solanacearum

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<210> 34
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<213> Ralstonia solanacearum

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gaggccatgg tcaatgatct gcgttcggtg atacgggtcg cccaagagag gcaaggtcaa 300

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gcgggctacg acggctacaa acgcaaacgg ggcagcaagg ttcacatggc agtggatacg 420

ctgggccatc tgctggcggt gcatgtcacg ccggccaatg aacaagagcg tgcgcaggta 480

gcggaattgg ctcgtcaggt tcagcaggcc acaggccaaa ccgtgaaggt agcgtttgcc 540

gaccaggggt ataccggtga agcgcctgca caagccgcgc tggatgaagg aatcgacctt 600

caagtcatca agctatcaga ggccaagaaa ggctttgtgc tgctgcccag gcgctgggtc 660

gttgagcgta gctttggctg gctcaaccgc ttcaggcgac tcgcccgtga ctatgaacgc 720

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gccgtgccga tcatgcaaag tgcctaa 807

<210> 39
<211> 807
<212> DNA
<213> Ralstonia solanacearum

<400> 39
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gcgggctacg acggctacaa acgcaaacgg ggcagcaagg ttcacatggc agtggatacg 420

ctgggccatc tgctggcggt gcatgtcacg ccggccaatg aacaagagcg tgcgcaggta 480

gcggaattgg ctcgtcaggt tcagcaggcc acaggccaaa ccgtgaaggt agcgtttgcc 540

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caagtcatca agctatcaga ggccaagaaa ggctttgtgc tgctgcccag gcgctgggtc 660

gttgagcgta gctttggctg gctcaaccgc ttcaggcgac tcgcccgtga ctatgaacgc 720

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gccgtgccga tcatgcaaag tgcctaa 807

<210> 40
<211> 210
<212> DNA
<213> Ralstonia solanacearum

<400> 40
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ggcagcctgg atgagcgtga tgaggcgatt gaggcctggg aggcggcgat ccagtcgaac 180

ctggagcaga ttgccgagct ggaaggctga 210

<210> 41
<211> 369
<212> DNA
<213> Ralstonia solanacearum

<400> 41
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aggacggttg tcgccggagg cgtctggcgg gaccgagtag cgggtaggac tggggcggtg 180

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ggccgctgcg ccgttttccg gaggtggtag gtacgtgggg aggggtgacg gtcgcgcgcc 300

ccgcccgccc gcagcgaagc gaggacggac ggggcgcgcg cagcgcgccc ctacttgtag 360

taataacac 369

<210> 42
<211> 1563
<212> DNA
<213> Ralstonia solanacearum

<400> 42
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atcaagctct cccagtttta cggcatgaaa ttggacgatt tcgctcatga gatcgccatc 120

ctttctctgt ggctggcaga acaccaaatg aaccaaaagt tcaaagagac ttttggacat 180

accaatccag cccttccttt gaagagcagc ggcaacgtcg tcagcgataa cgcaatccat 240

gtcgattggg acgagtttct tgctcccaaa gcagagcatg agacatacct tcttgggaat 300

ccaccctacc ttggagcacg taaccaggaa ccagagcaga aagcagacct tgaactgatt 360

tttgaaggcc acgaggaata caaggactca gactatgtct gctgctggtt catcaaggcc 420

gcaaagttca ttgctggcaa aaatgccaag tatgcgttcg tggcgaccaa ctcaatctgc 480

caaggtgagc aggttgccta cctatggcct agagtcttcc agcctggtct tgaaattgac 540

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gtgattgttg gggtgaggaa cacggctgac aagccgaagc tgctgtttgg agccgacagc 660

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taa 1563

<210> 43
<211> 111
<212> DNA
<213> Ralstonia solanacearum

<400> 43
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tgaatcagtt cgatgggcgt gagcatgttg gcgttgagcg cggcgagcca c 111

<210> 44
<211> 138
<212> DNA
<213> Ralstonia solanacearum

<400> 44
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tcgagcagac gctgcgcaac ctgcacgacg tacagccgac ggtgtacttc aacgtgccca 120

agggctggga gatgctga 138

<210> 45
<211> 312
<212> DNA
<213> Ralstonia solanacearum

<400> 45
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cgatcgccga gggcgaatcg attcccgtgt ttgccgggcg cgagcgctgg caggtctggc 120

ggcggcgcgc tgactgatcc ggtggcgtcg gcgtcgcagc ggcgcgttcc ggcgaccgtt 180

gtgttggtgc gaagcaacaa gggcggcgac cggaaaaaaa gcctgcggac gcccattacg 240

gtccatcgct gaaaaaagtg gcagacgggg ccgcgttcgt ggtcgcaccg atgccccgcg 300

ggggtgtccc at 312

<210> 46
<211> 174
<212> DNA
<213> Ralstonia solanacearum

<400> 46
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gcgccgctcc agctcctgcg cctcgcgctc cggcatggtg gaaggatcaa tcaa 174

<210> 47
<211> 375
<212> DNA
<213> Ralstonia solanacearum

<400> 47
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gtcgaactgc tgctgctgtc gtcgctgtcg ccgtcgtcac caccgtccgg gggcggcatg 180

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gtggacgaag tcgacagacc gagctggctc agtgcctgct cgatcgcctg catgaagccg 360

ccgccaccgc catga 375

<210> 48
<211> 1026
<212> DNA
<213> Ralstonia solanacearum

<400> 48
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gcgccgctgt ccgtacggcg catgggcttt gccatggccg tctctatgct cgaagcatcg 120

accgacccgc gcgcgccagc atgccgcgca tgcggccggc ccatcgacaa agccgccacc 180

caggcggcag tgagccaatc cgcgcccaga cggaaggctc gacggggagg tcaccatgcg 240

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cctcgtactc gtgttcgacg gcacatggca cccgggcggc gtagtcggct gccgcaccgt 420

caacgtctcc gacagcaaca acgtggtggg cgcggaggtc aacctgctga tcgcgcccgg 480

cacgatccgg ccgcgcgtgc aggccgtggc cggcagcacc agcgtgcagg cgctggtcgg 540

cggcggctac gacttcgcca gcggcaaggc gctggtcggc gtgggcgtca ccggcgatca 600

ctggctgggc ggcgccgact acgagatcgc cggccgctgg accgcatacg ccggcgtcag 660

cacgctcaac cgctatcacg ccaacgcgcg tccggacccc atcgccccga cgccggtccc 720

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tccggcgcca gcacccagcc caacgccgac cccggcaccc tgcggctgcc acggcggcga 1020

ccatga 1026

<210> 49
<211> 384
<212> DNA
<213> Ralstonia solanacearum

<400> 49
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gacggtgctc tcatcgcgga gcactacgag gccgaggaca tgtacgcatt gaagacgcat 180

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caccgcctta ccagttcgga ggaatcgcgg cttctgaaga agctggagcg gcgtggcttg 360

ctccttacgg agcagatcgc ataa 384

<210> 50
<211> 639
<212> DNA
<213> Ralstonia solanacearum

<400> 50
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gttttcgcga gcattggatt cgctgctcac gctgtcgccg acgagatgtc tacacagcgc 120

gttgacggtg tgtcactgtc cgtgcctacg gcctggcgcg tagacacggc tgaattcgaa 180

aaggatagag cacaggctga tgccgctcac accaggcgaa gccgcacgct gttggccgtc 240

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aaaccagata cgttctccgc aatgccggac caaacgaaaa accgccttgc tcgtcagttg 360

caagagtttg tcgagcgctc aacggggctg cccgcaaagc gcagcgtcat catcgaatgg 420

acgccttacg agacagtcga tatctcgggg cgacaaacgc tgcacaacct cgcgactgtc 480

catttgcgaa accagccggg tgctcaagac ctgttctata tcccaacgat gggcggcatg 540

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gaaatcgcca gcagcatccg ggttgatggg aagttctga 639

<210> 51
<211> 882
<212> DNA
<213> Ralstonia solanacearum

<400> 51
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tcgggaaacc acacgttgct ggatgggcat atacggctgc tggtgctgca cgaccttggg 240

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atcaaccgcc tgtcgagcgt ccaggagcac ttcatgatcc ggcgtgccat tgagcgtggc 360

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tcgccagagg tagcccgcgc gattcgcaag atgcggccaa cgcgacaggt cgagtgcgtg 540

gaattgatga tcgccgcgaa caatgtcacc gtcgcctatg cagaagcgtt gcttgttgcc 600

acgcctgcct ctcgtcttgt tgatggaaag aagccggcca agctaacagg cgtgacgcac 660

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gaacagacct acggccaaga cgtactcaat cttgtgctcg ctaaagggta cctcgtgagg 780

cttctcgagt gtgagccggt gcaagcctat ctacaccaac accagcctga cctcgtgcgc 840

gagttcgaat cgattcgcga cgtcgtttcg ctggagcagt ag 882

<210> 52
<211> 870
<212> DNA
<213> Ralstonia solanacearum

<400> 52
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<210> 53
<211> 1566
<212> DNA
<213> Ralstonia solanacearum

<400> 53
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<210> 54
<211> 1406
<212> DNA
<213> Ralstonia solanacearum

<400> 54
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ctttgcaatc agccctggat ggtgcgcgca ccggcggcag cattacgatc tgcaccctcc 180

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gccagtagtc gctatggcac tgactccatg cagcgcggga ccgcgcctgg ttgtcgcgat 420

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<210> 55
<211> 1906
<212> DNA
<213> Ralstonia solanacearum

<400> 55
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tttgggacaa atcaggactg agccggctgg tccggtccat gggtaggggc gtactttgag 180

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acgcataatg acggcagaac gtgccactcc ttcgcgaatt gggactttcc ggttctgata 480

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<210> 56
<211> 909
<212> DNA
<213> Ralstonia solanacearum

<400> 56
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cgcgtcgact tcgtaacgac tatcggacgg cgcggcatct gcccacagag acgggatcct 180

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gtggatgtgg tgcttgaaag ctacgcggaa tgggtaggcc ccgaacgttc gcatgcggca 540

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atggtcgcaa agctcggcct agcgagcctt cgtgcacctt cggcttacat ggttggtgct 720

actggaccgc tgtcgggtgc ccgcttgcta ttcgccggaa cgaccgaggc aatgcacatc 780

tcgtgcgcgc aagctgacca actcctggtt gtgcttgata accatctgaa cgttggaatg 840

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<210> 57
<211> 852
<212> DNA
<213> Ralstonia solanacearum

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gtcaaccaag tcagcaacgt catcgagaag ttgagcggca acaacgatac acgccgtgcg 180

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ggaagcctac atttgtactc gaagaacacg gaccaggcga caaagtatgt cgacgagggc 480

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gcgctggtag atgcggaacg ggaaattcgc ttggggcacg ccgtgaacgt caaccagttc 600

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gacgcgtgca tacagcaacg cgttcgcaag agccagcctg cgccggagct cgccgagcct 780

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<210> 58
<211> 1315
<212> DNA
<213> Ralstonia solanacearum

<400> 58
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cagaagaaga actgaagctg ctcttgaagc gagttcaaga agaagatgct cttggtgact 540

tggagtttga agataaagca gtagatacca tcattggcta tgcagacggt gatgcaagaa 600

ggttcttgaa cctgcttgag caatgcaaaa cggctgctgg tgctgctggt gttcagcatg 660

ttaatagtga cttcattcag aatgccctaa ctctcaatag caggcgtttt gacaagggtg 720

gagacaactt ctatgaccag atttcagcct tgcacaagtc tgttcgtggc tccaaccctg 780

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ctcatgacga acccaatgcc tatgctgctg gtgaaaccta ccttcctgaa ggcatagaag 1200

agccgggttg gtatcagcct gttcctagag ggttggagat caagattggt gagaagctgt 1260

ccctgctgaa gaagtgggat gaagaagcca aaaagaactg aataagggga tcaga 1315

<210> 59
<211> 1950
<212> DNA
<213> Ralstonia solanacearum

<400> 59
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acagaagtga agatcacatg gcccgatgtt caacttgaaa agcagttcaa gattgcggac 180

aacggtcatg gcatgacccg tgaagagttt caatacatct ggcggaccat agcctacaac 240

cggttgtcgt caggtggaaa cacaacggct cccccagcag atgttcaagg cttgccacgg 300

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gatccgctcg ttctagaaga aatatcgttc aaggaaaagg gtgttgaggg tcatggaacg 480

gagattgtgg gtaacggcat cattccccgg ctcatgttct cggaagagaa agctcgtgaa 540

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gctgactatc taaatgccca agatgcagtg ctgggtgatt ggagtggctt caaggacgaa 900

aaccaggcgt gggtgaagac ccgcgaggcc gttcaagatc gcatccgcca aatcattttt 960

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aagctggagc agtccaagtc tcgctatggg ttgcttgatc tgctgcacaa gtgcgagcca 1200

aacgactacg acacccttca tgacatcctg aaggaatgga ccatagggat ggcaaagctg 1260

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gtggaagctg acccagtggt ggcgaaatga 1950

<210> 60
<211> 765
<212> DNA
<213> Ralstonia solanacearum

<400> 60
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aacaaggatc tctatgttgg cggttctgta ttttgtcgca tggtgcagca ggtcgatcct 120

ggctcaccaa gctaccaaca gttgctgccg ctgagacaaa gccaaggaaa gtccaattcg 180

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aacattgtgt tcggcggtgg ttatgcggtg cccactacgg ttgttcccgt tgacctctgg 360

aactctgaga agctgaacaa cagtctcaat gacattgacc atgccattga tgctcaccat 420

tacaaccggg caacgacact gagctacacg tgtcttgaag ggctctacaa gacatacgtt 480

cgcaagcacg ttcctggaca aatggcgctg acggatctca tgccattgtg caaggtggtg 540

aaggaggaca tcagcaagaa gcttcaggca caaggcccgt ttcctgtcga gattgtcaat 600

gccatgccga ccttgaccaa tgccattgcg aactcaagaa acggcttcag tgaatctcac 660

tttggtgacg actcccagcg gtggcttgct ttgtttgctc gtgatctgac caactcaatc 720

ggtcgtctca tgctcaactt catgtgacca ccggcgagag gaaga 765

<210> 61
<211> 1149
<212> DNA
<213> Ralstonia solanacearum

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aacgattgca ataacaagtt gggtcagagc tgggatgcgg agcttgcaag gcaacttaac 180

tggttttcct tggcagtcgg catcagtaga gagcgaggtg agccacctaa acaggttgtg 240

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gttgaagagg caaagcagcg gattcaaggt atcgccagaa aatacccgaa gtttgacgtt 420

gaaaaagctc tcaatgagtt ggagataaaa accagctatt tggattcgcc tcttcatgtc 480

agtctttctt tgggtgggcc agaggctgga aggtctgtag tcaaaactgc gttttctttt 540

gcatctgaat gtggtgttcc acatgctcaa tgcgagaagg ctcttgaata tcttctagat 600

cctactgctg aaaatttccc ctttggattt gcctacttgt ctgacctggt tgaaaaccga 660

ccaaaggaca agatttttca ttgtgtgtct ttgcatggtg atccaaagaa gaagcggcta 720

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ttcgaccaag aaaagcatag agcagcggcg gactatgccc tgcctatcat cctggataga 960

gggcgaagcc gaaccttgga gcgcacagtc aaggaaggct ttgaacatgc tgccaagcag 1020

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atgatggaga aaatctctcc atacatagag catctagttc gtagtgggca cagaaatgac 1140

caaccataa 1149

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<211> 693
<212> DNA
<213> Ralstonia solanacearum

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aagcacaagg tagacctgtc tcccttggat gagagttaca gagctatcat ttttgtgggt 120

gccaaccaga acccgccaaa agcttccaag aagccagcaa cagcccatag gttcaagagg 180

gtggacttcc tgaagatttc aggtgctggc aagaatgcct tggacttcca catagccttt 240

gaactcggca ggaccttcga gactgcacct gatacccaat gcttcgtgct cagtggtgac 300

aaaggctttg acccgctgct gaaccacttg aatagcaacg gtatgagttg ccgaagggtg 360

gaaagcattg atgagcttgt gccagctacg gtggtgcctg tagcagttcc atctgatgtg 420

gttgtctgcc ctcactgtaa gaaggccagc accattgagc atcacggcgg ccactggtgt 480

tctaactgtg gaaggtttgc tactccacca gatcccaagc tgctgccgtc caatcaaccc 540

ggctacaggc agtctcaaag agacaggtct gaagaagact atgccatcta ttcggtatgt 600

ggctggtgcc atcaaagaac tgatatgact ggcggtatct atgacgatgg ggaatggatg 660

tgtggaggct gcattgccag gtgcgccaga tga 693

<210> 63
<211> 939
<212> DNA
<213> Ralstonia solanacearum

<400> 63
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actgctgctg agactgccgc aaccgtgtct catcgggcat ccatcaaggc atgcctggaa 180

aataactttg gcttgaaacg cttcacccga atcggttcgt ttggcaatgg aacaaatgtg 240

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gaagttgtcg ttgcagacta tgtgaaagaa caaaatggct acaaggtcta tgaaatagct 480

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aatgaaggtc tgtccgccat gcaagaccct atggggatcg ctggctatat ctatccttgc 780

aacagtgacg ttcagaagat tgacgcactc tcaaaactaa acacggcagc tacacgggcc 840

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ctgctttata acgacaaatt ccccacctac tacctatga 939

<210> 64
<211> 843
<212> DNA
<213> Ralstonia solanacearum

<400> 64
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<211> 178
<212> DNA
<213> Ralstonia solanacearum

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ccatatcttg aatttggcaa aatccagaaa acgcgaccag atgggcaaga ggaaataa 178

<210> 66
<211> 1580
<212> DNA
<213> Ralstonia solanacearum

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<222> (1202)..(1549)
<223> n is a, c, g, or t

<400> 66
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tgagacagcg attgaaatta aaaaagcacc tctagggtgc ttttgttttt ttacatggcc 300

tgctttgttg gaatgaatgc gtgtattcgt ttcaatgaag tgggtgctcc ttagctgtga 360

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<210> 67
<211> 2445
<212> DNA
<213> Ralstonia solanacearum

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<221> misc_feature
<222> (1077)..(1966)
<223> n is a, c, g, or t

<400> 67
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cgttgatgct ggcgttgtgc cgatctttgc gaatctgcgc gtcacgcacg cggataaaca 360

gcttgtcggc cttgggcagc caacaacggc catccgaatc cagatgcgga gccagcgtcg 420

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cgcggaccac cgcacgcagc acgggtggca aggttctcag caaatcttca tcgacagccg 600

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caagtgggcc gtcacgtgcc ggacttggac agcttggccg tagctgaatg ccaaacgatt 420

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tttatcggta tggccagcgc ttcgacggtc gccggttaca gctatcgggt tctgttccgc 360

cagcttcgcc gcgcgcgggc cgactacatc aagaccgcgc tcaagcgctg ccgctccaag 420

aacaaggtgg cccgcgcaga catgttctgc gaaggatggg tgtttgccgt gcgcgagctg 480

gtgggtgcca ccgtgccgcc cgaagcccac cgcagcgcgg tggatgccta catgcgcgcg 540

aactatgccg tgaccgagca agttgagacg cggtgccgcg aacctgggcg ccatgtttcc 600

caggtgggcg actgcgtgca aggcgttcgc gctgggcgcg gcgccaccct ccatcgtggg 660

gttggaacag gggtggatgc accccaaatg ctgggggcat ga 702

<210> 87
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<213> Ralstonia solanacearum

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gagctgacga tcaccgacct gggcaagttc ggctccgtgg agcgtgccgc caagaccggc 180

cgcaacccga agactggcga cgttattgcc attgcggcca agcgcgcgcc gaagttctcg 240

gctgccaagg ccctgaagga tgcagcagcg gcctag 276

<210> 88
<211> 633
<212> DNA
<213> Ralstonia solanacearum

<400> 88
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cgcgagctgg tggccaaagc caaggcactg caagcagcca tggccgattt caaacgccaa 180

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ctggccatca gcgacgacaa gtggacgtgc gccatgcagg ccatcggcga gtcggtggat 540

gtggtgggca ccacggccta catccgcttc tacgagcgcg ccgagggtgc caagaagccc 600

acagccgtca ccctggactt tgccgctctg taa 633

<210> 89
<211> 588
<212> DNA
<213> Ralstonia solanacearum

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gactcgttca tcaagccgct cctgcgctac atcggcctat ttggaccgaa gaagacgcag 180

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caagaagtgc gcgaagcccc caacaacctg aagaaaggac gccaatga 588

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<213> Ralstonia solanacearum

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tgccgccact ccacatcgcg caccgcgtgg atctcttcgc ggtcgatggc gcgaagctgg 180

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cggtggcata gatgcgcttc cggcgccgtg tatgggtaat cgtgatgccc ggtgggtcaa 480

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<210> 91
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<210> 92
<211> 1296
<212> DNA
<213> Ralstonia solanacearum

<400> 92
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<210> 93
<211> 975
<212> DNA
<213> Ralstonia solanacearum

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<210> 94
<211> 2388
<212> DNA
<213> Ralstonia solanacearum

<220>

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<222> (1457)..(2385)
<223> n is a, c, g, or t

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cgaccctgca ggtttgacag ccggtgcttg cgtttagaac gtggttaggg ctgcagaagc 180

ttccggagct caggcaaggg accgtttctg tcaaaaattt gcgaagcaag aaaggcttcg 240

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gcggcaatgg ggaacgcgag catcgcgtgg tctgggtcaa aagtgtaaag gtgtattttg 360

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<213> Ralstonia solanacearum

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gtaagccttg tcggcatgca gcttgtcggg gcgcttacgc ggccggccat ccaggccacg 240

tatcgcggga atcgcatcc 259

<210> 96
<211> 255
<212> DNA
<213> Ralstonia solanacearum

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gcgctttatt tggatgagca aggcaatttg attgtggagg atcgtattca ggttcacatg 180

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<210> 97
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<212> DNA
<213> Ralstonia solanacearum

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tggcggacga ctggctgccg ccgatggggc tgtcgggttg ttgtacctct acggcgagca 240

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ggtcagtcag tagaagcccg agcatcgggc cactgatatg caggcggcat gagcgacgtg 420

ccaccgctac aagtacacat caagcagttt ttggggaagt ttctgtgcaa tcaccacacc 480

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<210> 98
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<213> Ralstonia solanacearum

<400> 98
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cagctctaca agaagttcat agccctggac atagacatcc caggctcttt tgatctttgg 180

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cgttacctgg cagacattca aagcttcggg gcggtggttc agattttcag gaagatgggt 660

ggtggctcgt cattcagaaa agaatatgta ctagagcctg actgtcgtag aggttatgga 720

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ccgaagaaat aa 852

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ctatacgaaa aaatgatgga agccgagcat gcctaa 216

<210> 104

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<400> 109

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<210> 112
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accatcgtgg atgccccct cattgaagcg ccccgt 457

<210> 113
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<213> Ralstonia solanacearum

<400> 113
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aggaggcagt tgctggccag tcctgggagc attgcgtcct ga 102

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<400> 114
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gccaattcca gccaggccaa gggtcgtgtc gaacgtatga atggcacgct gcaggatcgc 180

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cagcccgagc atcgtccgct ggtccaccgc tatgtcgagg tggcggaata tcccgacggc 480

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gatgccgcac cgcctcaggc caactcgact gccctacgga aacatcccgg aaaggcacca 840

agaaagaaga gcaccacact gcactaa 867

<210> 115
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<213> Ralstonia solanacearum

<400> 115
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cttacgccca acgaaatcgc caagctgcgc ctgtccgact atctgcaggc gaatggggag 180

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caaggccgat cgaccaagct gatccaagag ctgattgggg tgtcgagcct ctccgccgtt 600

aagagactgg tagagagtga tcccgtgcgt ttggcctcca tcgtgagccg ggttatttga 660

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<212> DNA
<213> Ralstonia solanacearum

<400> 116
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gacgatcact ggctgaacct ggtggggaag ggcagtcgcg ctggtaaggt tgcgctgccg 120

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gcgcgttggg atccgaagac gccgatgatt ggtgggttgg ggctcgatcc caatggcagc 240

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cgccatacgc atgccaccca cgcgctcgca cgcggtgcgg aattgaccac cgtgcgcgac 420

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<210> 117
<211> 1167
<212> DNA
<213> Ralstonia solanacearum

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gcgtcgttca tcgagtggtg cggccttgtg ctgaacaagg ctgataacac ccagtttcgc 180

caagcgattg tggggctatt gcaggccgct accggctctg cgggctccac gtcgtaccgc 240

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<210> 118
<211> 557
<212> DNA
<213> Ralstonia solanacearum

<400> 118
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gccgccaggg cttgccagag cgcagccgga tcgaccaccg agcggtagta gcgcacgcgc 120

agcacgtagc gggatcgggt gccccatagg cggttgccaa tgtggctgcc cacacgcgca 180

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gtgtgcgccg tgagctt 557

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<211> 951
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<213> Ralstonia solanacearum

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cgcctcatgg ccaccgctag cacgggcaac gcgctggcca ccggtgtggc aggcatgccg 180

atccttgctg gcacgccgct gcgcggcccc aacgggctgg attacattgt ggcggcggca 240

gtcgatatcg gcgctggccc cactaccccc gtttccattc gctgcaccac caccggcctg 300

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gatgctgccg ttgccaccgt caccacccaa tacacccgcc tcgcgccgct ggccgatatc 900

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<210> 120
<211> 579
<212> DNA
<213> Ralstonia solanacearum

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gtagtcggcg cgagcaaggt gcaggtgcgc gtgctggacg aagagacgtt ggacaacatc 120

aaccgtgtgg agccctatgg cttttcctac cggccgaagg ccggctgcca aacgtacctg 180

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caaatggagc tggtggaggg cgaaatcgcc attcacgacg acgaacagaa ctgggtgcac 300

atcaagcgcg gcggcatcat cgaggtcaag gcgagcacga aggtgctggc cgatacgccc 360

atgttcgaga cgacgaaaga cgccaagatc ggcggtaacc ttacagtggc gggccaaacc 420

agctcggtgg gtggctactt cggcgacggc ggcggcgctg cgcagatgaa gggcggtgct 480

gatgtgaccg gagaactcag ggtgaatggt aaggacgtga gcgacaagca cacccacacg 540

agcacggccc ctggcacgcc cacttcggac gtgaattga 579

<210> 121
<211> 1056
<212> DNA
<213> Ralstonia solanacearum

<400> 121
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gtggaaattc gggagtcggt ggacgatctg tgcgccgccg tacagctcgc catcgcgcgg 120

ccgggcagcg gcgcgaacgg cggcagcggc atgggcatga cggcgaacac cgtcatcgac 180

gtgctgatcg gcgacgagct ggtgacgaag gtgcgaccgg atgtcaaccg ccgccgcgtc 240

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gccacgttca aagtgtctgt gaagatcgac gctgaaacgc ccgtggtgcc cagtttttcg 420

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ctgtatccgt tgccggacgg tggcctggtg ctcacgtcgc ctaccagcgc tgcgcccgtg 540

gccacgctgc aatacggcat gcacttcaag gtctacgagg tcatcgacga atacaagctg 600

cggttttcgg actacgttgt gaagacgttc gactacagca gtgattccgc actcaagggt 660

gccgtgaagg acaatggcat cacgtatttc cggcccatgc acgttgtggc ggaccgacac 720

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<210> 122
<211> 1161
<212> DNA
<213> Ralstonia solanacearum

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cccgaggtgg aagacctggg cgcgaaggcg tgggactgga agctgaacgc ctatttcatc 180

gggccggact acgatctgga gcgcgatgcg ttcttggaac tgctcaacca gccgggcgcc 240

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cacgagagca acgacaaggg cggctattgc tccatcacga ttgacttcgt gccgggcggc 360

ggcacggtag ccgctgggga aaccgatgcg gtggacgtgg cctatgaccg caacagcagc 420

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<210> 123
<211> 2145
<212> DNA
<213> Ralstonia solanacearum

<400> 123
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aatgccgcga ttcagaagac tgccaaaacg gcagagcaga ctgctgccaa gacggccacg 120

gccaccgaga aggcggcgca gaaggctgcc gatgcagccg agaaaagcgc cgcgcgccaa 180

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<210> 124
<211> 354
<212> DNA
<213> Ralstonia solanacearum

<400> 124
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gccgggcggg acggccgcgg ccactttcgg gatcgccacc cgtccctgca cctgctgacc 180

ttctgtgtgc tggtattgcg caatggtttc accgtgaccg gtgaatcggc ctgcgcaagc 240

cctgagaact tcaatgccga aatcggccgc aagattgcgc gccagaacgc tgcgcaaaag 300

gtgtggccgc tgatgggcta cgccttgcgc gacgcactgc acgccgcaac ttga 354

<210> 125
<211> 1473

<212> DNA
<213> Ralstonia solanacearum

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<210> 126
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<212> DNA
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<400> 126

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gctgagaacg tgacgctggc cttcgatgtg gtgattgcca ttgaaaaccg ccgcacgcac 240

aagcaaggcg atacggacga tgagttgctg aagtaccgca ttgccgtgaa aacgctgctg 300

ctgggctggc agcttcagcc tggcgtgcgc cccatcaagt tcgtcggtgg ccaagtcctg 360

gagtacaccg acggcgattt gtactggcgc gatcgctacg agttcgacgc cttgattacc 420

aactacctac cggacccgcc tgcatttgac aggctcattt acacgggaga aaagctgtga 480

<210> 127
<211> 480
<212> DNA
<213> Ralstonia solanacearum

<400> 127
gtgatttcgc tgacgccact gattgaacac gtgaagttga agcctgccga gttcgcaggc 60

atctggtttc ggcaggtagc tggtgctgcc gagttcgccc aggttcgccc tgaagcgttg 120

ccgctgccgg ccgcgtggat cgtccgggca gcagacaagg tgcagcacgc aggcgagcgg 180

gctgagaacg tgacgctggc cttcgatgtg gtgattgcca ttgaaaaccg ccgcacgcac 240

aagcaaggcg atacggacga tgagttgctg aagtaccgca ttgccgtgaa aacgctgctg 300

ctgggctggc agcttcagcc tggcgtgcgc cccatcaagt tcgtcggtgg ccaagtcctg 360

gagtacaccg acggcgattt gtactggcgc gatcgctacg agttcgacgc cttgattacc 420

aactacctac cggacccgcc tgcatttgac aggctcattt acacgggaga aaagctgtga 480

<210> 128
<211> 903
<212> DNA
<213> Ralstonia solanacearum

<400> 128
atgggtgcac tcacgcaagc ccagttggac caactgaaga ccacgctgat tgcccgctgg 60

aatgctggct tggtgctgac gccggaagac tggaagaaga tcgccaagct agtcaccagt 120

accggcaaat ccaacaccta cgaatggctg agccagttcc cggccttccg ggaatgggtc 180

ggcgcacgcc tgcacaagaa gttcaaggaa accgcctatc aggtggtcaa ccgcaagttc 240

gagtgcacgg tggacgtgca gcgtacggac atcgaagacg acgaaatcgg ccagtacggc 300

accatcgccg agtcggccgg ccagtcggcc accgatctga agaacgatct ggtgtttcaa 360

gcgctgggcg ctggcttcgc ctccgtctgc tacgacggcc agtatttctt cgacaccgat 420

cattcggtgt acgagaacga agacggcacc ggtgccgtca ccaacgtgag caacatgcag 480

gatggtgcgg gcgcaccttg ggtgctgctg tgcacgaagc gcgcagcgtc tccgatctac 540

ctgcaacagc gcatgcccgc ggagttcaac agcatcacct ccacgcagaa caccaacgtc 600

ttcgacctgg acgtgtacag cttcggcggc cgttggcgcg gcgaggccgc ttacggcttc 660

tggcaatgcg cgttcggctc caaggctgcg ctcaacgctg ccaacttcaa cgcggcctac 720

gaggccatga tgaagttcag gggtgacggt cagcgcaagc tgggcatcgt gccggacacg 780

ctgctctgcg gcccggacaa catggccgat gccgaagcgc tgctgaaggc cgcgcagaac 840

gccaacggct ccagcaacac caactacaac aaggtggaac tggtcgttac gccctggctg 900

taa 903

<210> 129
<211> 984
<212> DNA
<213> Ralstonia solanacearum

<400> 129
gtgacgcaga atccccccat cgcacaaacc gcaatagccg cgctagcgtt cgagttggtg 60

cccggcagcg atggtgccgt tccgactgaa gcccatttgc tgccgctcgg cccgttccgg 120

gcaacggatg gtcgcccgtt cgactgcgcg gcttggcagc tcgacgccgc catcgccgcg 180

cgcgtgatcg cgctggccga gcagcagaag aacgacatcc tggtcgacta cgaccaccag 240

agcctgaaca aggaacggaa tggccagcgt gccgatgcgg ctggctggat tccccgcacg 300

ctcgaatggc gcgaaggcaa agggctctac gccaccaaca tcgcatgggt cggcgacgcc 360

gcccagctca tcgcgcagaa gaagtaccgc tacatcagca ctgtcttctt ctacagcccc 420

gtcacaggtg aagtgctcga aatcctttcg gtcgcactca ccaacacacc cgccctggat 480

gggctagaag ccgtggccgc tctggcccgc aagcaattca attttcgaga aggggagttc 540

gacatgtcgc agcaagaaat cgccgcgctc acgaccgagc gtgacggcct gaaatcgcag 600

ctcgcagcgc tgaccactga gcgcgatggc ctgaagacca acgttgctgc ccttacggca 660

gagcgcgaca cgctgaaggc caaggtggaa ggcatcgaga aggaagaagc cgaagccgcg 720

ctggccgcag agcgcaaaca acacggcgat ctgctgaaag ccgcgctgac cgatggccgc 780

ctgaccccgg cgcagaagcc gtgggctgaa aagcaatcgc tggccgcgct gacagagtac 840

ctggacgcca gcaagccgct ggccatcctg gacaagcagg ccgatggcaa gagcgaaggt 900

gcccatggcc tgacccacga agagcttgcg atgtgcaaga agatgggggt caccccgag 960

cagtacgtcg ccgccaaacg ctga 984

<210> 130
<211> 948

<212> DNA
<213> Ralstonia solanacearum

<400> 130
atggacaagc aaacgacctg gcccgcccat tacgccgccg cagacgttgc gcttatcggc 60

cgcattggcc cctggatgga agagcgtggt tacacccaag ccgctctggc gcggctggcg 120

cgcatcagcg caagcagctt gaaccagatt ctcaaaggca gctatgccac cagtccgggc 180

aagctgctgg cgtcggtgga ctcggccatg cgccacgctg aagagacgaa ggccgatgtg 240

gtggccccgg tcgaaaccag cgtcttcaag ctcgcgcacg ccgcgtgcag catggcccgc 300

cgctatcgca acttcgcggt gttcaccggt tacgtgggca cgggcaagac ctttgccatc 360

aagcaatacg tggcatcgca tccgaacacg cacctgattg aggccacgcc caccatgacg 420

ccgcagagcc ttgtgcgtct gctggcccgc gtggtggccg gctatgacgg caagggcagc 480

attgatgaca agttccgctc cgtggtgacg gcgcttcgca acaccgacag tctgctcatc 540

gtggatgagg ccgaaacgct cacgccgcac cagctccaca cgctgcgccg cctccgtgat 600

ctagccaacg tcggcatcgt gctctgcggc accgaacacc tgtcgggcct catcaagccg 660

ctgcatggcc agtttgacca aatccgctcg cgcacgggct tctggcccga gacggtgcgc 720

gccatcaacc tggaagacgc cgccgccctg gtgcaagccg gcttcggcac ggaagacgta 780

cctgaagagg tggtgcaacg cctttaccaa tactgcaagg gcagcgcgcg gatgctggtg 840

gaggggttgg tcgctggcat caaggagttc cgccgtgggc gtccgctgga cgtgaagctg 900

gtggatgcgg tggccaaaca ggcgctgtgc ctgcaatcgc tggcctga 948

<210> 131
<211> 531
<212> DNA
<213> Ralstonia solanacearum

<400> 131
gtggaccgct acgccaaccg cccgcaccca gaagaccaga acacgacacg cgccgcgctg 60

tggtcgcaac tggcaccgct tccgccgcac gccaacgtga ccgaactgaa gcgccaggcg 120

gtggtgctga cggtgaatcg cgcagccatc aagcacggca agcgtgccta cacgcacccc 180

gagctgcacg ccttcaacgg ccacagggtg gtcatggaat acgacctgat ggatgaccgt 240

gtcgccgtca tgcgcacgca ggaaggccgg tggatttgcg acgcacacct cgtcacggcc 300

attgacgcca tcgcgcccaa ccgcctggaa gaaaagcgcc aggcgcgcgc cgccgatgcc 360

atcaagcgcc tgcaacaaaa gatggacgag cagaaggccc gtgcgggcat ggtgctcgat 420

gtggacagcg tggccgacgg cgtgctgcct gcaatcgagg tggaagcccg cctggtggac 480

gacagcgacg acgcgccgct gctgctcgac ctgacgatga acgacgaata a 531

<210> 132
<211> 884
<212> DNA
<213> Ralstonia solanacearum

<400> 132
atggcacggg cacaactggt tcagcgcgtg gacgcaggcg gcgcaagtgg cgcggtagcg 60

gtcatgccca cagcaaaggt gctggcgctt cgtgctcgcg acccgtggcg cgaggcaacc 120

gacagggccc ggcaagtggc gacgtggcgt gagacggtgg tggcgtacgt gcgcgccatg 180

acggaagacg gtgtgacgca gaacaacgcg gtggcgctgc tgctggagcg cggcgaggcc 240

ggcagcctgc ccagccactt cgccatggcg ctggctggcg ccgccaaggc aggccggaag 300

acgccatcgc gctccgccat ctgcgaatgg tgcgctcagt atcgcgaagg cggcgcaact 360

gcgctgctgc ccgaccacaa gggccgcgtg gtggaggccg ccggctggtg ggggccggcg 420

ctggagtatt tcaacgcgcc cggcaaacca gatatggccg ctgtacatcg ccgcctggcg 480

gaagtggacg gcttcgcggt cagctacgac caagtacgca actacctgac gggggttcct 540

gccatgctcg gccgcaacag ccccgcacgc attggccgca acctgtaccg cctgaccgag 600

aaggcataca tccgccgctc gaccgaaaac gccttgcccg gcgatgtgta tgtggccgac 660

ggctaccgcg cggacgtgta cctggcgcac cccgtcacgg gcgatatctg gcgcccggag 720

ctgacggtgg caatcgacat gcgcagccgc ttccccgtgg gatggcgggc cgacgaacat 780

gaaggcacgt atgccgtgca gaacatgtgg gcagagtgct tcgcccgctg gaaccacgtg 840

ccgccgatgc tctacatcga caacgggtcc ggctacaaga acac 884

<210> 133
<211> 1125
<212> DNA
<213> Ralstonia solanacearum

<400> 133
gtgaagccga ccatgacgaa gaaaaccaaa gccgtacaag caaccgaaga tatcgacctg 60

ggcatcacgg aaggcgctct agttcacgcc acgcagacgg acgacgcgca gccagtggat 120

attgcaaccg ctgcggcggt gctgcccatc gcgctcgcac cagtggcgaa tctcgccgca 180

gtcgcgtcgc atttcaacgt gaccaccgat gacctcggcg agctggcccg catcggcgct 240

gactctatcg gccgtgccat gttcgaaatt acgcgtgctg ggatggcatt tctgcgcgcc 300

caagagttga tttcgcttgg gcatggtggg gatcgcagat cgactcccga acgttcggga 360

gttgaaaagg acggctttct gacctggatc aacgcgcatg gacttgcaaa ccagcgcgtg 420

tacgaagcca tgcgcatcgc gaagtttgtg gctcaactgc cgcaagacga actggaaggc 480

gtgctggcgc tcggcaaggt caaggtgatg ctcttggcct cgctgccgca ggaagtcatc 540

gaccaagccg ccgagtccgg caacgacatg atcggcaaag ccgacctgat gacggtggcc 600

gaactcaagg aagagattcg cgcgctgaag cggcgtgaaa agaactacga agctgagctg 660

gagcgtgcgc actcgcaggt caaacgcctg tcgcaagtaa atcgcaccac cgaattcctc 720

ttgcgcacag aggaaatccg cgaagagtgc atggccctgc aacttggcgt tgaactcaac 780

acttccagcc tgaaaaagct gttcgatgag gtcaacggcg acgagtcgcc cgaatggcgc 840

ctccagatgg aacagatttg ggtgacggca cacgtcatgg cttcgcgcgg cctggatttg 900

atcgaccaca tggccagcct cgtgcgcgaa gacgacatgc ccgaacgcat ccaaggcacc 960

cacatcctca gccctgacga ggcccgccaa tggctgatcg actacccgat gatcgaaaac 1020

cgccacgccg ccgaagcagc aaaccggcaa gagaagcgtg atgcagccaa accgcgcggc 1080

gccggccgtc ccaagggttc caccaacaag gctaaggggg agtaa 1125

<210> 134
<211> 180
<212> DNA
<213> Ralstonia solanacearum

<400> 134
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gcaaaggaga agggctttga ataccgcacg gttatcgcgg tcatcaacgg cgtgaacaag 120

gggcgttacg gcgaggctca caaagtcgcc gtggcactgg gtctcaagaa agctgcgtga 180

<210> 135
<211> 369
<212> DNA
<213> Ralstonia solanacearum

<400> 135
atgaccatcg gagagcgttt gaaggaagag cgcgagcgat tgcgcctcac ccagccggcc 60

attgcctcgg ccgccgacac gacgaagcaa acacagcacg catacgaaac cgaccgcacg 120

ccgccgaaag ccagctatct ggccgcaata gcgatcctgg gcgttgatgt ggcttatgtg 180

ataacggggg agcgggcgct taatacggcg cgcacgccga tggaagttgc actgctggag 240

aactaccggc acagcccagc agaggtgcag cgggggggtta gcatgcttct cgcacaaacc 300

tccggagccg cagattcagt cgccggaaag ggaaagaaaa atcgatcctc ggaggaagtg 360

aagaagtga 369

<210> 136
<211> 318
<212> DNA
<213> Ralstonia solanacearum

<400> 136
gtggcaaaca acacgctgtt gagcatcaac ggcatgaaca agcgtttcga cggtgcttgg 60

ctgatgctgg acgcgagtgc attgccacat ccttccgact tgacgcgggc gggcgggttg 120

ttgctccgcg ttgcgaaggg ctaccactac ggcaaccatc tggcccttgc tcaggaggcg 180

attattggtg cgcaaagaag caaggggaag caatcctgca ttgacgatcc cgcatcaggt 240

agccgcctct gcgtctcgac cgataacggc acgatctaca acatgatctt ggagcaagcc 300

gagcccaaga agggctga 318

<210> 137
<211> 336
<212> DNA
<213> Ralstonia solanacearum

<400> 137
atgaaactcc ctcgccttac cacgtggatc atcgccacca ttgcgctggc gatcatcatc 60

ggtctgctgt ctccgcagca actacccgtc agtctttaca agctctcgtt ggtcaccatg 120

gctgccgtgg tggcgtactg gctcgaccgc gcgctgttcc cctatgcccg gccggccggc 180

tacctgtcca gtgcggactg gcgcaaagac gggcctatgt gcgatgacgc cgaccacgcc 240

attgttaccg gctacgagct ggtgtttgcc gccgccatgc ttcgccgcgc cgtcatcgtg 300

gccggtgcga tgctcgccat cggtctgggg gcgtaa 336

<210> 138
<211> 633
<212> DNA
<213> Ralstonia solanacearum

<400> 138
atgcgccgcc agtcgatcct cttgagcgtg ttcgccgcgc tccagctcgc ggcggcgctg 60

ctgctcgcat cggcagatgc attcggtgct gatgccgcca tcccgcacgt cgcgagacgc 120

taccgtgcag acctgacccg cattgcacgc gaggcatggg gacttgacgc acccgtggct 180

gtgttcgccg cacagctcca ccaggaaagc ggctggaacc ccgcagcggt ctcgcgtgtt 240

ggtgcgcaag gtatggcgca gttcatgccc gccacggcga aatggtggtg tgtgctgaat 300

ggccttgcca acgatgcgtg ccagcccacc aaccctgtgt gggctatgcg tgcattggtg 360

ggctatgacc gctggctgta tgagcgcgtg cgcggtgcat ccgagtttga ccggctgtgg 420

gctgcactac gtgcgtacaa cggcggactg ggccactggc aacaggaagc ggccacggtg 480

cggcctgcgc tgaaccgcgc aaccatcgat agcgcatgtg gcacagcgcg ccgccatcgc 540

agcttctgcc ctgagaacct gggctatccg catcgcatct tgaacgtctt gcagccgcgc 600

tatctggcgt gggggcgtgg ggtacggaca tga 633

<210> 139
<211> 495
<212> DNA
<213> Ralstonia solanacearum

<400> 139
atgacccgca cgctgattgc aacggcggta gccgtagcgt gcggtgccct tagcgcgtgg 60

agctacacac gcaatcacta cgtggccgag attgctggca tgacggccga tcaagccacg 120

gcccgagaga aagccgagaa gatcgcgcgt gagctgctcg aagccgagca aaagcgcggc 180

aacgcgctgt cggacacgtt ggccaagaaa gaaaccgcga tcaccgaaaa gacccaggag 240

cttgccaatg cactatctcg cctcactact ggccgcaagt gtctcgatgc tcgcgttgtg 300

cgcgtgctca acgactccag caccggcacc gctactgaca acgtgcgcgc caccaccggc 360

acatctgatg cagcggatgg acccgctgcc accgataccg acgtcgctag ctggatcaac 420

cacgccaaag gccaatacga aatctgccgg gctcgactcg gcgcactgat cgactttgaa 480

aaagggcgag ttcaa 495

<210> 140
<211> 153
<212> DNA
<213> Ralstonia solanacearum

<400> 140
atgaagcggc agatgagctt tgcagaagcg gaaagcgcag gtaagaagcg cgtgaccaaa 60

cgccagcgct tcctggcaga gatggagaag gtcgtgccgt ggcagcgctt gctgtcggcg 120

attgggcccc actatccgag aggcgagcga ggt 153

<210> 141
<211> 23
<212> DNA
<213> Artificial sequence

<220>
<223> Primer

<400> 141
ctgaattcga aaaggataga gca 23

<210> 142
<211> 23
<212> DNA
<213> Artificial sequence

<220>
<223> Primer

<400> 142
ctcgacaaac tcttgcaact gac 23

<210> 143
<211> 22
<212> DNA
<213> Artificial sequence

<220>
<223> Primer

<400> 143
ctatgcagaa gcgttgcttg tt 22

<210> 144
<211> 23
<212> DNA
<213> Artificial sequence

<220>
<223> Primer

<400> 144
ctttagcgag cacaagattg agt 23

<210> 145
<211> 23
<212> DNA
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<220>
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<400> 145
gagatcgttg gaaacatcaa gac 23

<210> 146
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<220>
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<400> 146
gtgaaccact attgccggta tc 22

<210> 147
<211> 23
<212> DNA
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<220>
<223> Primer

<400> 147
agaactgcca agttcgacta cct 23

<210> 148
<211> 23
<212> DNA
<213> Artificial sequence

<220>
<223> Primer

<400> 148
cattccaacg ttcagatggt tat 23

<210> 149
<211> 22
<212> DNA
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<220>
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<400> 149
gcagaaaaga tatcccctgc ac 22

<210> 150
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<212> DNA
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<220>
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<400> 150
ttcgagtaca aatgtaggct tcc 23

<210> 151
<211> 23
<212> DNA
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<220>
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<400> 151
gatcagatgg agcaaagaac act 23

<210> 152
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<220>
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<400> 152
tattgaaact cttcacgggt cat 23

<210> 153
<211> 23
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<220>
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<400> 153
tttcgaccaa gaaaagcata gag 23

<210> 154
<211> 23
<212> DNA
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<220>
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<400> 154
atttctgtgc ccactacgaa cta 23

<210> 155
<211> 23
<212> DNA
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<220>
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<400> 155
tggtgttcta actgtggaag gtt 23

<210> 156
<211> 23
<212> DNA
<213> Artificial sequence

<220>
<223> Primer

<400> 156
taccgccagt catatcagtt ctt 23

<210> 157
<211> 23
<212> DNA
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<220>
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<400> 157
attagactga tcaaggcatg gaa 23

<210> 158

<211> 23
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<220>
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<400> 158
ccttcattat tgagacggtc aag 23

<210> 159
<211> 23
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<400> 159
atgtttgtgc tactggtcag tcc 23

<210> 160
<211> 23
<212> DNA
<213> Artificial sequence

<220>
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<400> 160
ccttcacttg cagataatgg aac 23

<210> 161
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<400> 161
aaagaagctc aaggagatca agg 23

<210> 162
<211> 23
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<220>
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<400> 162
aacagcaggt tgtgatactg cat 23

<210> 163
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<212> DNA
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<400> 163
cgagctcatc gttatcgaca t 21

<210> 164
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<212> DNA
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<400> 164
aagctcttgg actaggacga tct 23

<210> 165
<211> 23
<212> DNA
<213> Artificial sequence

<220>
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<400> 165
tgaaatgctc aaagacaaac aga 23

<210> 166
<211> 22
<212> DNA
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<223> Primer

<400> 166
atcgtacagg tcattgccaa at 22

<210> 167
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<400> 167
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<210> 168
<211> 23
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<400> 168
aaagccggtc atagaggaca tag 23

<210> 169
<211> 23
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<400> 169
caaccagacc atctacaaga tcc 23

<210> 170
<211> 23
<212> DNA
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<400> 170
gcttcatact caaatcgaac acc 23

<210> 171
<211> 23
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<220>
<223> Primer

<400> 171
aactccaact tgcttgactg ttc 23

<210> 172
<211> 22
<212> DNA
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<220>
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<400> 172
ggatgaactt cgttcgattg ag 22

<210> 173
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<212> DNA
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<220>
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<400> 173
gaagctcggt gatatcgaaa c 21

<210> 174
<211> 21
<212> DNA
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<400> 174
ggtgatcgct gtcgataatt t 21

<210> 175
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<400> 175
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<210> 176
<211> 23
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<220>
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<400> 176
ctgattgcca atattcgatt ctc 23

<210> 177
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<210> 178
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<210> 179
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<400> 179
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<210> 180
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<400> 180
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<210> 181
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<400> 181
ccactacccc tgtttccatt c 21

<210> 182
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<220>
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<400> 182
aaacctgtag tcgtcgtcct tg 22

<210> 183
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ggctgctgcc 70

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gtctcagccg 70

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gattaaagtg 70

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gctgatgttc 70

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gtggacgatt 70

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cgagatcgtg 70

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gcgttgcgcg 70

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gctgaagcca 70

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tgatggccgg 70

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cgacgcctat 70

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gttcgacgcc 70

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gctttggccg 70

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aatggctgag 70

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gaagccgtgg 70

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tggcgtgcgg 70

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cgtgtgtcgg 70

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gcgtgcggtg 70

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ccgcccgaag 70

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caagttcggc 70

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tggatcgaag 70

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caactacctg 70

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acggacgacg 70

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agctatctgg 70

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caagcgtttc 70

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atcgatagcg 70

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gcactgatcg 70

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tggcaggagg 70

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tgatctggag 70

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ccaagatgcg 70

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gcgatgttcc 70

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gctcagggcg 70

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accacttggc 70

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<400> 388
aagcaaacga gataagggag aac 23

<210> 389
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aaacacaatt caccttcctg atg 23

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Claims

1. A method for the detection of *Ralstonia solanacearum* race 3 biovar 2 strains in a medium, comprising the determination of the presence or the absence in a sample of the medium, of:

   (i) at least one first nucleic acid target having a sequence selected from the group constituted of SEQ ID NO: 1-49, complementary sequences thereof, and homologous sequences thereof, or
   (ii) at least one fragment of said first nucleic acid target, wherein said fragment is not constituted of or comprised in a sequence selected from the group constituted of SEQ ID NO: 111-140;

   whereby, if said first nucleic acid target or fragment thereof is present in the sample, it is determined that *Ralstonia solanacearum* race 3 biovar 2 strain is present in the medium.

2. The method according to claim 1, wherein the medium is selected from the group constituted of a potato tissue, a tomato tissue, and a geranium tissue.

3. The method according to claim 1 or 2, wherein the medium is a potato tissue.

4. The method according to claim 3, wherein the potato tissue is the tuber.

5. The method according to any of claims 1 to 4, wherein the sample is obtained from the medium by a nucleic acid extraction.

6. The method according to any of claims 1 to 5, wherein the determination comprises at least one step of hybridization of the nucleic acid target or fragment thereof with a probe or a primer.

7. The method according to claim 6, wherein the probe or primer is a fragment of nucleic acid having a sequence selected from the group constituted of SEQ ID NO: 1-49, homologous sequences thereof, and complementary sequences thereof.

8. The method according to claim 6 or 7, wherein the probe or primer is selected from the group constituted of SEQ ID NO: 141-386.

9. The method according to any of claims 1 to 8, wherein the determination comprises at least one step of nucleic acid amplification.

10. The method according to any of claims 6 to 9, wherein the determination is implemented by a method selected from PCR and NASBA.

11. The method according to any of claims 6 to 8, wherein the determination is implemented by a method selected from Southern blotting, Northern blotting, dot blots, and nucleic acid micro or macro-array hybridization.

12. The method according to any of claims 1 to 11, comprising the determination of the presence or the absence in a sample of the medium, of:

    (i) at least one second nucleic acid target having a sequence selected from the group constituted of SEQ ID NO: 111-140, complementary sequences thereof, and homologous sequences thereof, or
    (ii) at least one fragment of said second target nucleic acid.

13. A nucleic acid having a sequence selected from the group constituted of SEQ ID NO: 1-22, SEQ ID NO: 50-110, SEQ ID NO: 111-140, SEQ ID NO: 141-246, and SEQ ID NO: 247-386 and their complementary sequences.

14. A nucleic acid micro or macro-array comprising a plurality of nucleic acid probes arranged onto a solid support, wherein the nucleic acid probes are fragments of nucleic acids having sequences selected from the group constituted of SEQ ID NO: 1-49, complementary sequences thereof, and homologous sequences thereof, provided that at least one of the nucleic acid probes is not a fragment of a nucleic acid having a sequence selected from the group consisting of SEQ ID NO: 111-140.

15. The nucleic acid micro or macro-array according to claim 14, wherein the nucleic acid probes comprise SEQ ID NO: 247-386.

16. A kit intended for the detection of *Ralstonia solanacearum* race 3 biovar 2 in a medium, comprising at least:

- two primers suitable to amplify a portion of a nucleic acid having a sequence selected from the group constituted of SEQ ID NO: 1-49 and complementary sequences thereof, provided that said portion is not comprised in a nucleic acid having a sequence selected from the group consisting of SEQ ID NO: 111-140 and complementary sequences thereof;
- optionally one detectable nucleic acid probe suitable to hybridize to said amplified portion.

17. The use of:

(i) at least one first nucleic acid target having a sequence selected from the group constituted of SEQ ID NO: 1-49, complementary sequences thereof, and homologous sequences thereof, or
(ii) at least one fragment of said first target nucleic acid, wherein said fragment is not constituted of or comprised in a sequence selected from the group constituted of SEQ ID NO: 111-140;

for detecting *Ralstonia solanacearum* race 3 biovar 2 strains.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 29 1213

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	TEROL J ET AL: "Random genome sequencing of Ralstonia solanacearum strain IVIA 1602 and comparative analysis with strain GMI1000" JOURNAL OF PHYTOPATHOLOGY (BERLIN), vol. 154, no. 9, September 2006 (2006-09), pages 556-564, XP002465338 ISSN: 0931-1785 * the whole document * & DATABASE EMBL [Online] 30 November 2005 (2005-11-30), "Ralstonia solanacearum GSS, clone II122R" retrieved from EBI accession no. EMBL:AJ863704 Database accession no. AJ863704	1,17	INV. C12Q1/68
D,X	GABRIEL DEAN W ET AL: "Identification of open reading frames unique to a select agent: Ralstonia solanacearum race 3 biovar 2" MOLECULAR PLANT-MICROBE INTERACTIONS, vol. 19, no. 1, January 2006 (2006-01), pages 69-79, XP002465339 ISSN: 0894-0282 * the whole document *	1	TECHNICAL FIELDS SEARCHED (IPC) C12Q
A	WELLER S A ET AL: "Detection of Ralstonia solanacearum strains with a quantitative, multiplex, real-time, fluorogenic PCR (taqman) assay" APPLIED AND ENVIRONMENTAL MICROBIOLOGY, WASHINGTON,DC, US, vol. 66, no. 7, July 2000 (2000-07), pages 2853-2858, XP002977122 ISSN: 0099-2240		
D,A	WO 2004/042016 A (NASA [US]) 21 May 2004 (2004-05-21)		

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~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	22 January 2008	Cornelis, Karen

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 29 1213

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DATABASE BIOSIS [Online] BIOSCIENCES INFORMATION SERVICE, PHILADELPHIA, PA, US; June 2002 (2002-06), MARTINI M ET AL: "Molecular based methods for the detection of Ralstonia solanacearum (race3/biovar2) and for biovar differentiation" XP002465431 Database accession no. PREV200200420663 * abstract * & PHYTOPATHOLOGY, vol. 92, no. 6 Supplement, June 2002 (2002-06), page S52, 2002 ANNUAL MEETING OF THE AMERICAN PHYTOPATHOLOGICAL SOCIETY; MILWAUKEE, WI, USA; JULY 27-31, 2002 ISSN: 0031-949X -----		

TECHNICAL FIELDS SEARCHED (IPC)

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	22 January 2008	Cornelis, Karen

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
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& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
EP 07 29 1213

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-17 (all partially)

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 07 29 1213

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: Claims 1-17 (all partially)

A method to detect R. solanacearum race 3 biovar 2 by detecting SEQ ID NO 1 or a fragment thereof which is not in SEQ ID 111-140, a nucleic acid comprising a sequence as in SEQ ID NO 1 or 50-54, 141-146, 247,248, a micro array with fragments of SEQ ID 1 which do not encompass SEQ Ids 111-140, a kit with 2 primers to amplify a portion of SEQ ID NO 1 which does not correspond to SEQ ID NOs 111-140.

Inventions 2-22: Claims 1-17 (all partially)

A method to detect R. solanacearum race 3 biovar 2 by detecting SEQ ID NO 2-22 respectively or a fragment thereof which is not in SEQ ID 111-140, a nucleic acid comprising a sequence as in SEQ ID NO 2-22respectively or primers and probes accoring to Tables 2,3,4; a micro array with fragments of SEQ ID 2-22 respectively which do not encompass SEQ Ids 111-140, a kit with 2 primers to amplify a portion of SEQ ID NO 2-22 respectively which does not correspond to SEQ ID NOs 111-140.

---

3. claims: Claims 1-12,14-17 (all partially)

A method to detect R. solanacearum race 3 biovar 2 strain UW551 by detecting SEQ ID NO 23 or a fragment thereof which is not in SEQ ID 111-140, a micro array with fragments of SEQ ID 23 which do not encompass SEQ Ids 111-140, a kit with 2 primers to amplify a portion of SEQ ID NO 23 which does not correspond to SEQ ID NOs 111-140.

Inventions 24-49: Claims 1-12,14-17 (all partially)

A method to detect R. solanacearum race 3 biovar 2 strain UW551 by detecting SEQ ID NO 24-49 respectively or a fragment thereof which is not in SEQ ID 111-140, a micro array with fragments of SEQ ID 24-49 respectively which do not encompass SEQ Ids 111-140, a kit with 2 primers to amplify a portion of SEQ ID NO 24-49 which does not correspond to SEQ ID NOs 111-140.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 29 1213

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-01-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2004042016 A	21-05-2004	AU 2003287336 A1	07-06-2004
		US 2004086865 A1	06-05-2004

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- **GABRIEL DW ; ALLEN C ; SCHELL M ; DENNY TP ; GREENBERG JT ; DUAN YP ; FLORES-CRUZ Z ; HUANG Q ; CLIFFORD JM ; PRESTING G.** Identification of open reading frames unique to a select agent: Ralstonia solanacearum race 3 biovar 2. 1. *Mol Plant Microbe Interact.,* January 2006, vol. 19 (1), 69-79 **[0047]**
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